Special Features: Telecomputing On VIC & 64

COMPUTE!'s GAZETTE

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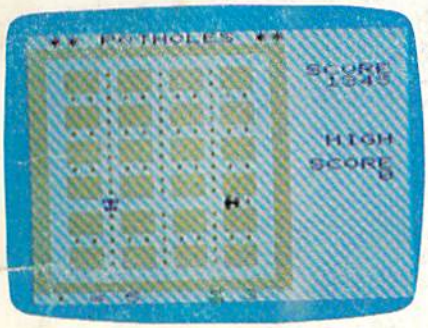
September 1983
Issue 3 Vol. 1, No. 3
63380 $2.50 in Canada

For Owners And Users Of **Commodore VIC-20**™ And **64**™ Personal Computers

POTHOLES

A game of skill and action for the VIC and 64



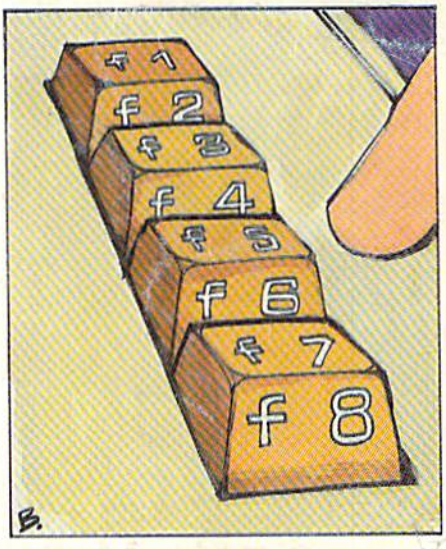
Only the very best drivers can maneuver their car through the potholed streets while being chased by the relentless Street Commissioner.

2 Great Games In This Issue!

News From The Summer Consumer Electronics Show: More Software, Lower Prices

How To Use Function Keys

By themselves, they do nothing. But they can be made to do almost anything – with a few simple programming techniques. Here's how to put those four special function keys for VIC and 64 to work.



★★★★★★★★★★

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A Complete Educational Program For Youngsters – VIC-20 And 64 Versions

Is Bangor the capital of Maine? Or is it Augusta? Then again, Augusta could be the capital of South Carolina...or is that Columbia? With "States & Capitals Tutor" you can learn to be sure.

Also In This Issue

Inside View: The Programmer Behind *Temple of Apshai*
Simple Answers To Common Questions
HOTWARE: This Month's Best Sellers
Machine Language For Beginners

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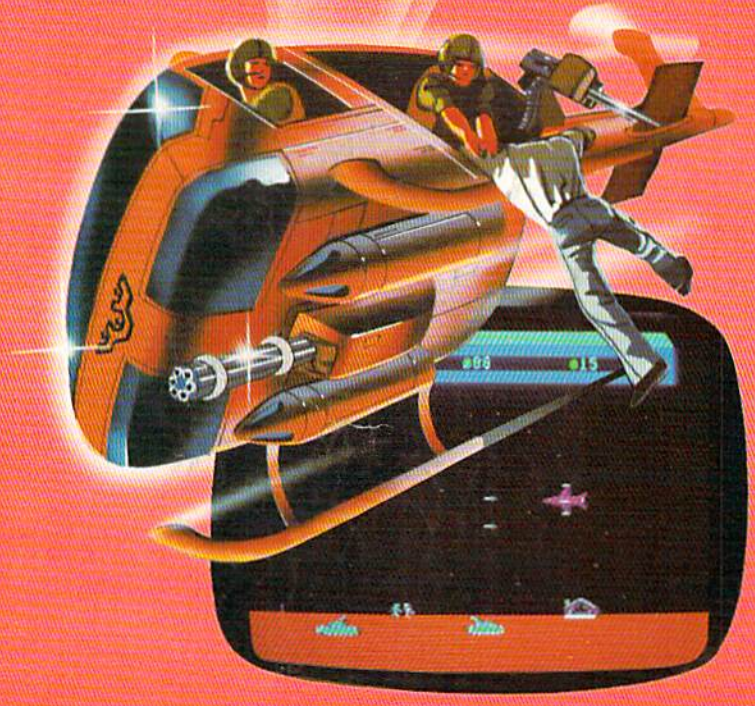
AMERICA'S FAVORITE COMPUTER GAMES



Now for the Commodore 64

CHOPLIFTER!™ It's the best selling game ever for the Apple. In its Atari 400/800 version, it zoomed to the top of the charts. Now CHOPLIFTER!™ is available for the Commodore 64.

Your challenge is to rescue peace-conference delegates held hostage behind enemy lines. Amid heavy fire from tanks, missiles and planes, you heroically maneuver your daredevil chopper. You'll need all your courage and skill to survive against treacherous odds. The game's remarkable graphics and realistic joystick control won't let you give up. After all, world peace rests in your hands!

Ask your nearest Brøderbund dealer for a sneak preview of Choplifter!™ and our other Commodore 64 games; David's Midnight Magic,™ Seafox,™ and Serpentine.™

And for VIC-20 owners, too.

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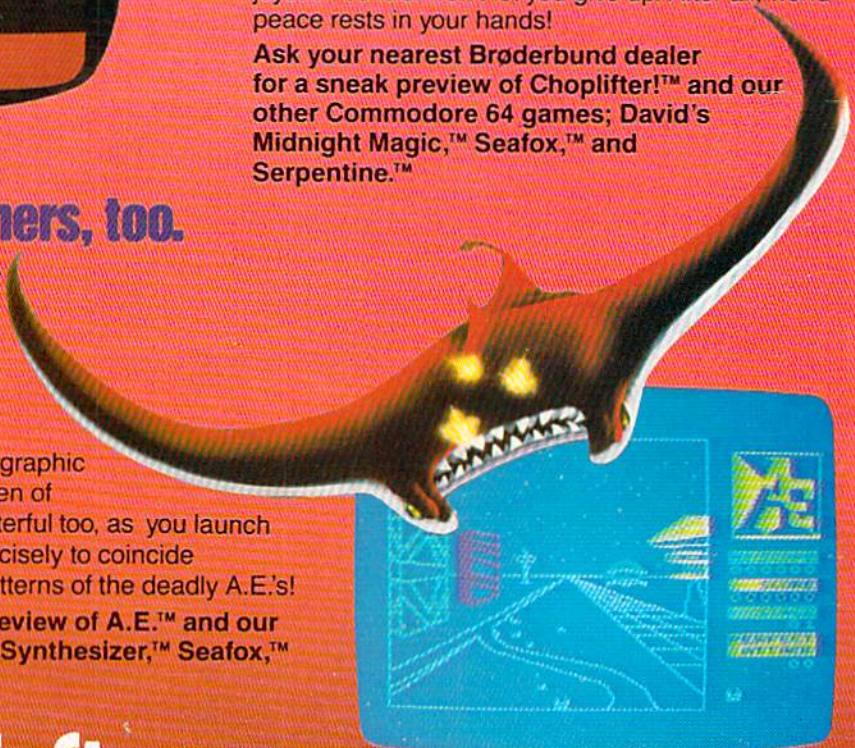

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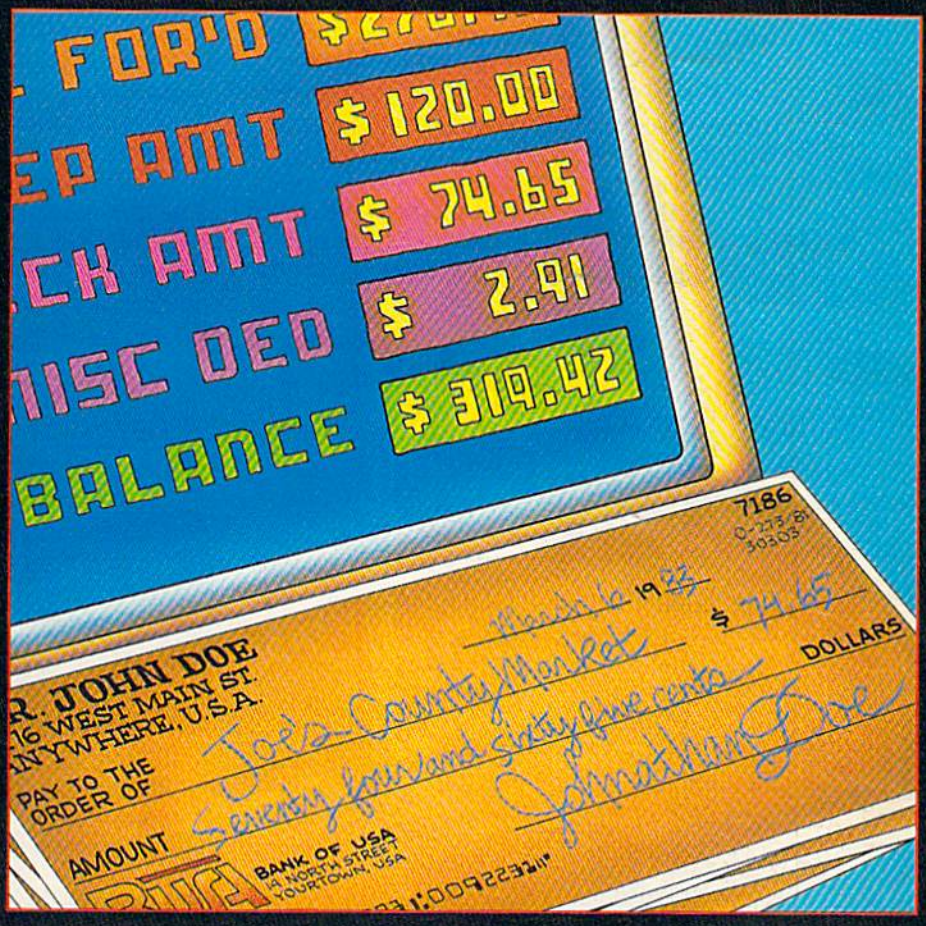

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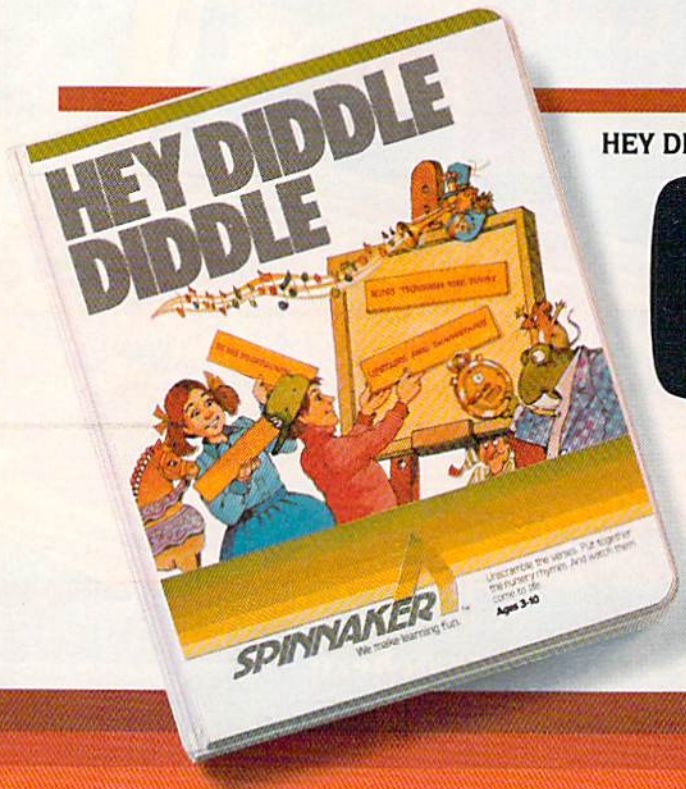
Watching your kids grow up is a lot of fun. But making sure their minds grow as fast as their bodies is even more rewarding. That's where we can help. With a growing line of Early Learning Programs that are not only lots of fun to play, but also educational.

Some of the games you see on these two pages help exercise your child's creativity. Others help improve vocabulary and spelling skills. While others improve your child's writing and reading abilities. And all of them help your child understand how to use the computer.

So if you're looking for computer programs that do more than just "babysit" for your kids, read on. You'll find that our Early Learning Programs are not only compatible with **Apple,®** **Atari,®** **IBM®** and **Commodore 64™** computers, but also with kids who like to have fun.



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Kids love rhymes. And since HEY DIDDLE DIDDLE features 30 classic rhymes with full color graphics and the neatest computer music you've ever heard, it makes rhyme games more fun than ever before.

Plus, it makes it fun for kids to read, helps them understand how words and rhymes create poetry and lets them take fragmented thoughts and rearrange them to form coherent verse.

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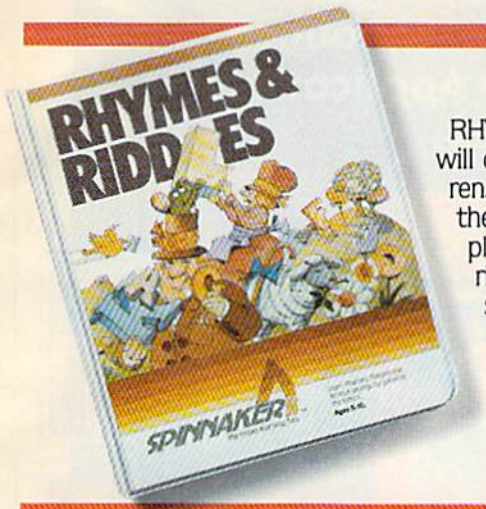

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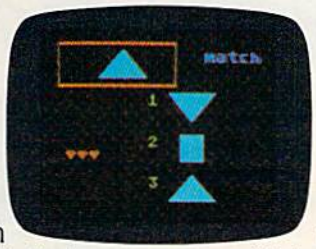
RHYMES & RIDDLES will delight your children. Because when they successfully complete the rhymes, riddles, and famous sayings on the screen, they'll see them come to life–with music and colorful pictures. And RHYMES & RIDDLES not only teaches children the correct lyrics to nursery rhymes and famous sayings. It also helps kids learn to read and spell while they're having fun! That's why parents like RHYMES & RIDDLES, too!

KINDERCOMP.™ Numbers, shapes, letters, words and drawings make fun. Ages 3 to 8.



KINDERCOMP is a game that allows very young children to start learning on the computer. It's a collection of learning exercises that ask your children to match shapes and letters, write their names, draw pictures, or fill in missing numbers. And KINDERCOMP will delight kids with colorful rewards, as the screen comes to life when correct answers are given.

As a parent, you can enjoy the fact that your children are having fun while improving their reading readiness and counting skills.

FACEMAKER™ makes faces fun. Ages 4 to 12.

FACEMAKER lets children create their own funny faces on the screen. Once a face is completed, your children will giggle with delight as they make it do all kinds of neat things: wink, smile, wiggle its ears, or whatever their imagination desires.

Plus, FACEMAKER helps children become comfortable with computer fundamentals such as: menus, cursors, the return key, the space bar, simple programs, and graphics. FACEMAKER won't make parents frown because their children will have fun making friends with the computer.

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We make learning fun.

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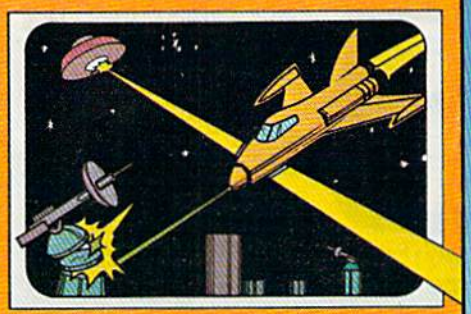

Joystick controller required.

THIS GAME IS ALSO AVAILABLE FOR THE VIC-20.

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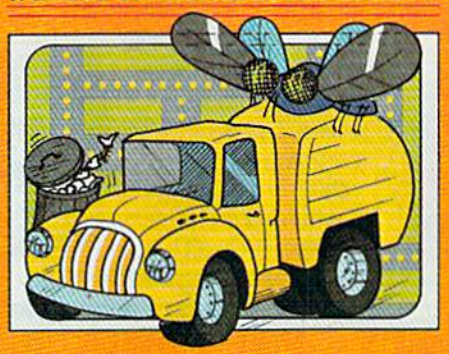
TRASHMAN

A GAME ON CARTRIDGE FOR THE COMMODORE 64™



Joystick controller required.

THIS GAME IS ALSO AVAILABLE FOR THE VIC-20.

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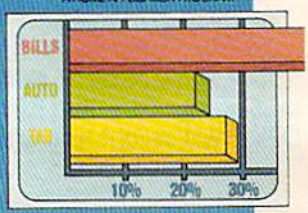

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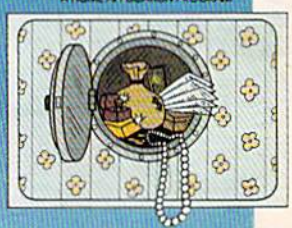

DECISION MAKER

A HOME APPLICATION PROGRAM

These Home Application Programs are also available for the VIC-20.

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THE EDITOR'S *notes*

We're off and growing! This issue our press run exceeds 200,000, and a strong fall selling season looms ahead. Our initial newsstand sales have been extremely gratifying, and we want to thank all of you who have participated in the first three issues as writers and readers.

Commodore's recent pricing moves in the area of software will escalate the current marketing battle between TI and Commodore. At the Consumer Electronics Show, Commodore introduced some significant new software and announced substantial price cuts in their software library. Watch for the continued availability of more and better software at more consumer-oriented price levels from both Commodore and outside vendors.

Elsewhere in this issue, Editor Tom Halfhill has an excellent report of the new products and strategies revealed at the CES.

Telecommunications today? This issue our featured theme explores the world of communication among computer users. We're quite interested in hearing from readers, on an ongoing basis, about your participation and projections for the future. Who knows, in the not too distant future, you may be able to dial up the current issue of *Gazette* programs and have them ready to run.

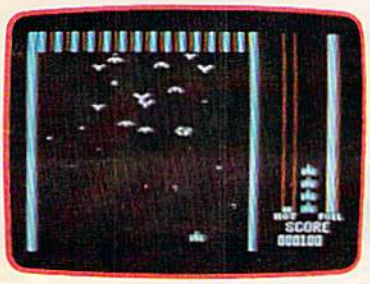
Now that many of you have had a two- or three-month exposure to *COMPUTE!'s Gazette*, we'd like to ask a few questions. Please use the Editor's Feedback card for your answers, or if you wish, drop us a letter. Are you happy with the mix of articles and programs we're presenting? Are the tutorials tutoring enough? Are you finding the applications useful? Finally, what do you feel about the placement of program listings in the back of the magazine? We'd certainly appreciate your input on some or all of these questions. Your feedback really is quite useful to us, and our in-house staff of superb writers and editors is helped by your comments.

Bits and Pieces: Management changes loom at Commodore? Software Division expands considerably. Outside vendors, well-known in other areas, now moving quickly to support Commodore VIC and 64 computers. Pre-Christmas season projects more and more higher end sophisticated applications software, especially for 64.

One last note: In order to accommodate several full-length feature articles this issue, we decided to omit the News and Products section. News and Products will resume in the October issue. Next month – The Anatomy of Computers, Telegaming, and a great deal more.

Editor In Chief

"YOU WON'T BELIEVE YOUR EYES"



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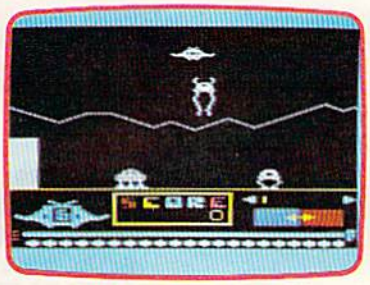

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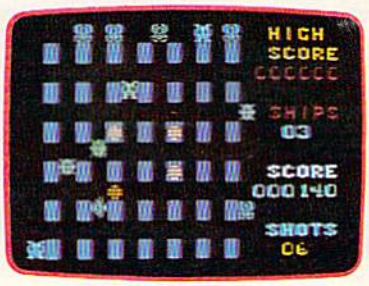

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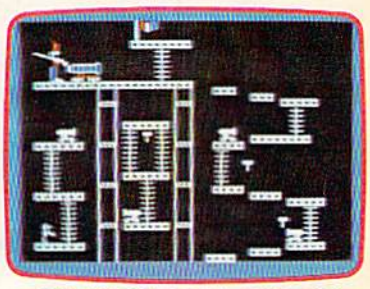

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GAZETTE FEEDBACK

EDITORS AND READERS

Do you have a question or a problem? Or have you discovered something that could help other VIC-20 and Commodore 64 users? Do you have a comment about something you've read in COMPUTE!'s Gazette *for Commodore? "Gazette Feedback" wants to hear from you.*

Blank Screen Problems

I own a Commodore 64. Lately I have been having problems with the screen. Sometimes when I use the tape cassette or the SYS statement, the screen becomes totally unreadable. The background turns white, all the letters turn to blank spaces, and the screen shows rows of dark blue spaces at random locations. Not even SYS 64730 (system cold start) is safe.

What causes this, and what am I to do?

Travis Miland

When loading programs from the tape recorder on the Commodore 64, the screen is supposed to turn blank. Because the 64's screen display is so much larger than the VIC-20's (40 columns by 25 lines), a lot of computer time is needed to produce and maintain the screen. As a matter of fact, the VIC-II chip (the microchip in the Commodore 64 that creates the screen display) needs about 8 to 10 percent of the computer's time just to "draw" the screen. That's why Commodore has designed the 64 to blank out the screen during tape loads. This helps to improve not only the speed, but also the accuracy of the tape loads.

As for your problem with the blank screen while using the SYS command (a command used to start a machine language routine), or the random blue lines, we have no answer. Because we do not know which memory location you are SYSing to, we can only guess at the problems you are encountering.

However, the random blue lines sound like a problem that might be specific to your computer, a hardware problem. We recommend that you return your Commodore 64 to the dealer and have it checked out.

Built-In DOS

I have had my VIC-20 for about four months now. I work for my dad's company writing data files. All I have is a cassette recorder right now. How much memory must you have on a VIC-20 to operate a single disk drive? I am going to buy a disk drive and more memory. How much do I need? I am only 12 years old, and I need all the help I can get.

Brandon Knight

The Commodore VIC-1540 disk drive, designed for the VIC-20 only, and the VIC-1541 disk drive, designed for use with either the VIC-20 or the Commodore 64, are both self-contained units. Because both have a built-in DOS (Disk Operating System – *the program that tells the disk drive what to do), they are "intelligent" devices and do not need any of the computer's memory. Either disk drive will work successfully with the unexpanded or the expanded VIC. This is not true with some other personal computer systems, which require computer memory to load DOS.*

Disk Drive Woes

A month or two ago, I purchased a VIC-1541 Floppy Disk Drive for my Commodore 64. After about 15 to 30 minutes of "playing" with it, I started getting read errors on the demo disk. Thinking I had a bad demo disk, I went out and bought a box of 3M Floppy Diskettes. To my dismay, I could initialize, with great difficulty, only three out of the ten diskettes in the box. Using one of the initialized diskettes, I tried saving one of my programs I had on tape, but I got read errors again.

Then I had the drive exchanged for another. My experiences with the second drive were like those of the first: frustrating! The second drive was returned for a full refund.

Later, I purchased a VIC-1541 from another source, and guess what happened 30 minutes after the drive was taken out of the box? More read errors.

Is it me, or is there an inherent flaw in the design of the 1541? I know that it's not my computer because the year-old 1541 that I borrowed from a friend works like a champ on my 64, and he doesn't have any problems with it on his VIC-20.

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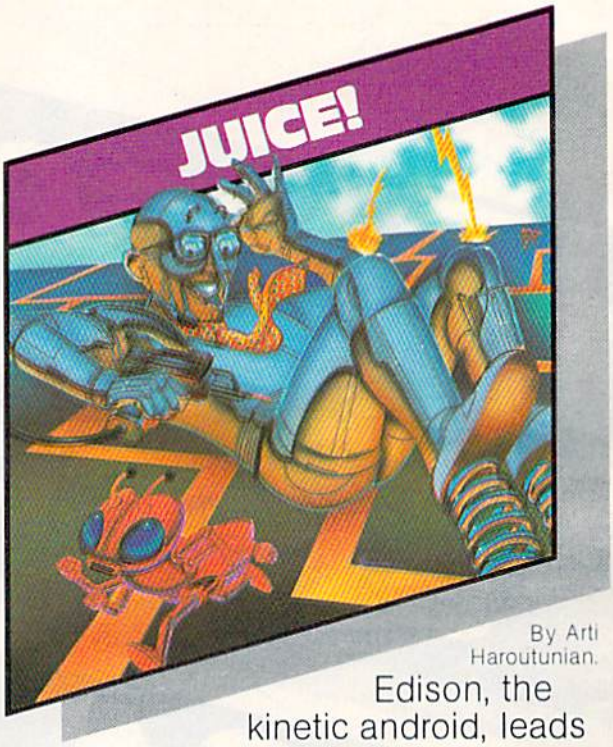

By Arti Haroutunian.

Edison, the kinetic android, leads a frustrating life.

All he wants to do is build his circuit boards and go with the flow. But things keep getting in the way.

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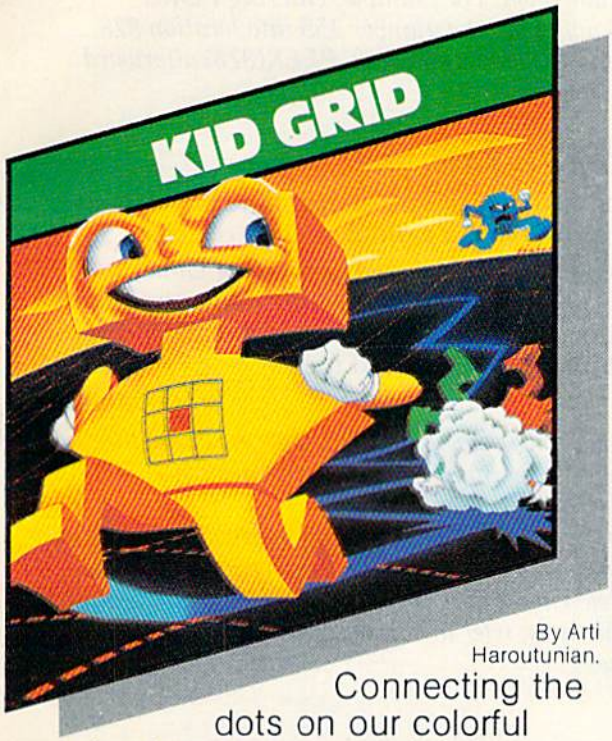

By Arti Haroutunian.

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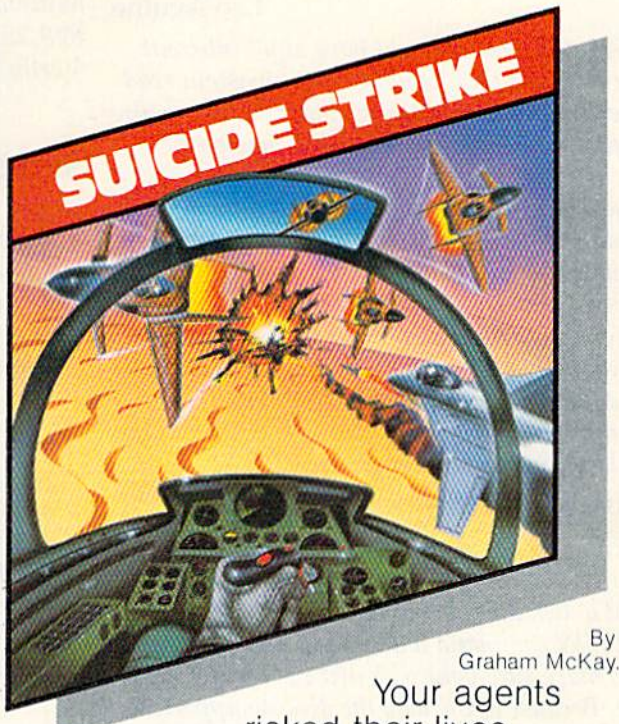

By Graham McKay.

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I did notice that if I shut off the drive for about an hour and then start it up, it'll work fine for about 15 to 30 minutes before reverting back to its old self again.

Leo Aguino

The 1540/1541 disk drives do not have any "inherent flaw" we are aware of that would cause consistent read errors. There are a number of things that may be causing your problems. Here are a few hints that may be of help.

First, you mentioned that with much difficulty you managed to initialize only three of ten new diskettes. Are you formatting your blank diskettes properly? All new blank disks must be formatted – that is, they must be "readied for use." As explained in the VIC-1541 User's Manual, *this is accomplished with a few easy commands. After switching on your system in the proper sequence (computer last), place a new, blank disk in the drive, type the following, and press RETURN:*

OPEN 15,8,15:PRINT#15,"NEW0:*name,id***".**

For name *you can use any label up to 16 characters long, and for* id *you can use any two-digit number. Never format a disk that already has wanted data on it, because the NEW command will erase it all.*

Second, make sure your disk drive is resting on a level surface. Because of the way the disk is supported and spins within the drive, an uneven surface could cause read errors.

Third, watch your ventilation. Place your drive in an open, well-ventilated area. Never block the cooling slots by piling papers, books, etc., on top of the drive, and avoid excessive weight on the drive. As is true with all electronic equipment, heat can be very destructive, so keep it cool.

Fourth, move the drive as far away from the TV as possible. The TV's magnetic field also is a common source of read errors.

Piqued By PEEK

I would like you to tell me just how a PEEK statement works. I have a Commodore VIC-20 and I have tried many ways to just see how it works, but nothing happens. I have used PEEK statements in programs, but when I try to use one outside a program, I get: SYNTAX ERROR, READY.

John L. Parker

The PEEK command is used to display the contents of one memory location, or byte. *When you PEEK a location, you are asking the computer to tell you what is in that single byte. It will return a value between 0 and 255. The format for the PEEK command is PEEK (x), where* x *is the number of the byte you wish to PEEK. X must always be a number from 0 to 65535. For example, if you type PRINT PEEK (1), the computer will display the number in memory location 1. (If you leave off the PRINT, the PEEK still works but the computer will not display the result.)*

The POKE command is just the opposite of PEEK. It will POKE, or place, any number into the memory location you wish. For example, entering POKE 828,255 will place the number 255 into location 828. Verify this by entering PRINT PEEK(828) afterward.

What Are Arrays?

I have owned my VIC-20 for over nine months now, and I still can't find a good definition of arrays. I have looked in the *Personal Computing Guide* and the *VIC-20 Programmer's Reference Guide*, and I still can't find anything. Could you tell me what arrays are and what they are used for?

Erik Fontaine

Arrays, although sometimes confusing, are one of the more useful programming tools you have and are well worth learning.

Arrays are a method of storing information within a computer in such a manner that data retrieval is fast and easy to reference. For more information on arrays and their structures, refer to "States & Capitals Tutor" in this issue.

BREAK-Proof Programming

I am a proud owner of a VIC-20. I've been learning BASIC for about a year now. I would like to know how to protect VIC programs. When I say protect, I mean that if someone presses the RUN/STOP - RESTORE keys, the program would continue without breaking. Also, how can I protect programs from being copied or listed?

Paul Bekeris

First, for those who may be unfamiliar with the RUN/STOP - RESTORE keys, a quick explanation. The RUN/STOP - RESTORE keys can be found on both the VIC-20 and the Commodore 64 computers. By pressing the RESTORE key while simultaneously holding down the RUN/STOP key, you can initiate a system "warm start" (a system reset that will not destroy or erase the BASIC program that is in memory). This warm start can be a useful tool if, for instance, a running program hangs up or "freezes" the system. By pressing RUN/STOP - RESTORE, you can interrupt the program and regain control of the computer.

Although there are many ways to protect programs, there is one way it can be done with two easy POKEs. To disable the RUN/STOP - RESTORE keys on the VIC, POKE 808, 100. To restore them to normal, POKE 808,112. On the 64, POKE 808,225 to disable and POKE 808,237 to reset. (These POKEs also turn the listings into "garbage.") To protect your program from being listed or saved once it is running, you can disable the entire keyboard. To disable the keyboard. POKE

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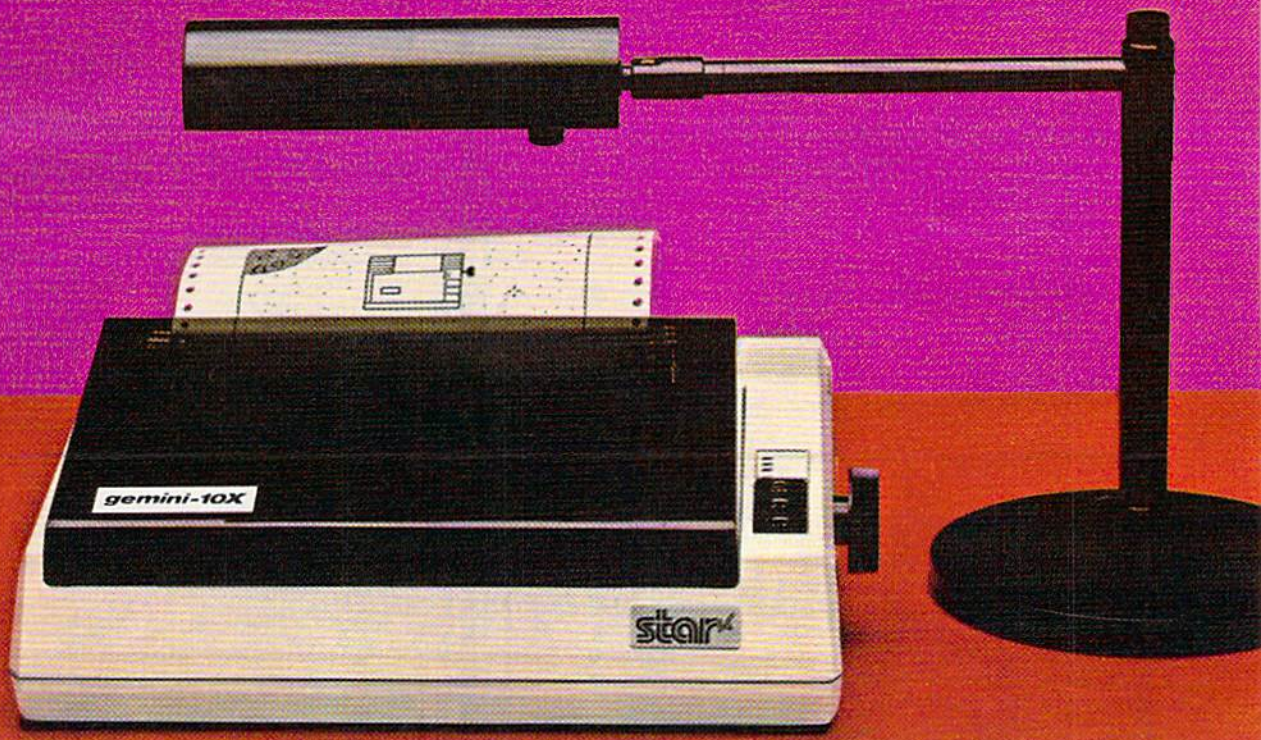

649,0 on either the VIC or 64. To return the keyboard to its normal status, POKE 649,10. There are many useful memory locations inside your VIC-20. This and more information can be found in COMPUTE!'s First Book Of VIC.

No Such Luck

Every time I type POKE 56, PEEK (56) +2 into my VIC-20 and then type PRINT FRE(0), the amount of K (memory) goes up. Is this real, usable memory or just a mistake made by my VIC-20? If this is real memory, will it damage my computer in any way?

Richard Rutiglia

No, this is not real memory. In the VIC-20 there are a number of memory locations (bytes) that tell the operating system, or computer, how much memory is available for use. A couple of these are locations 43 and 44, which tell the computer where the bottom of BASIC programming memory is, and 55 and 56, which tell the computer where the top of memory is. These locations are usually controlled automatically by the computer, but they can also be controlled (POKEd, for instance) by the user. When you POKE a value into location 56, you fool the computer into thinking it has more or less memory available than it actually does. POKEing a higher number does not create any usable extra memory. However, some programmers POKE lower numbers here to protect memory from BASIC for other purposes.

POKEing values other than normal into these locations will not in any way hurt your computer, but it can harm any BASIC programs that might already be in memory, or any BASIC programs that are loaded after the POKEs are made. If these locations accidentally get POKEd with bad values and you lose your BASIC program, the easiest way to reset the computer to normal is to simply turn it off and then back on again.

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SIMPLE ANSWERS TO COMMON QUESTIONS

TOM R. HALFHILL, EDITOR

Q A

Each month, COMPUTE!'s Gazette *will tackle some questions commonly asked by new VIC-20/Commodore 64 owners and by people shopping for their first home computer.*

Q. ***What exactly does "high-resolution graphics" mean? Is there such a thing as "low-resolution graphics"?***

A. Graphics resolution refers to the degree of detail with which a picture can be drawn by a computer on the TV screen. The higher the resolution, the greater the degree of detail.

Computer resolution is measured in numbers of *pixels* – picture elements. A pixel is a screen dot. Everything a computer puts on a TV screen is composed of these pixels, very much like the way a photograph is reproduced in a newspaper or magazine. Even the characters are formed of pixels. If you look closely at your screen, you may be able to see the pixels, although many TV sets lack the clarity to display each dot sharply.

There is no standard size for pixels. On a "high-resolution" screen, the pixels are very small. On a "low-resolution" screen, the pixels may be so large that they appear not as dots, but as small boxes or rectangles. Naturally, when the pixels are smaller, more will fit on the screen, so pictures can be drawn in finer detail.

The Commodore 64 has a high-resolution graphics mode with 64,000 pixels. This breaks down into 320 pixels horizontally by 200 vertically This is comparable to "hi-res" screens on other computers, such as the Apple (280 by 192) and the Atari (320 by 192). Also like these computers, the 64 has a "medium-resolution" graphics mode of 200 by 160 pixels.

The VIC-20 lacks such graphics modes. However, with clever programming, the VIC screen can be filled with characters which are redefined "on the fly," so to speak, to simulate a medium-res mode of 160 by 96 pixels.

Q. ***Sometimes when playing a game that I've just loaded from cassette tape, the joystick controls don't respond right. When I move the joystick in a certain direction, nothing happens. I know I typed in the program correctly, but the problem still crops up sometimes. What could be wrong?***

A. Often these kinds of problems are caused by mistakes in the program. If you're absolutely positive there are no typos, it's possible that your joystick is showing signs of wear. A worn cord, or a broken or damaged contact within the joystick itself, can cause erratic responses that are hard to isolate.

There's something else you might check first, though. If you left the PLAY button on the cassette recorder pressed after loading the program, release it with the STOP button and then see if the joystick responds properly. Often this will solve the problem.

Why? Because of a memory conflict within the computer. The memory locations which are used to control the joystick serve double-duty – they also detect if buttons are pressed on the cassette recorder. Therefore, if you leave the PLAY button locked down after loading a program, it can interfere with the joystick. Always press STOP after the program is loaded. This is a good habit to develop in any case, because leaving the PLAY button pressed for long periods of time when the tape is not moving deforms the rubber roller which maintains pressure on the capstan. A pinched roller can cause the tape speed to vary, leading to bad SAVEs and LOADs.

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Telecomputing means hooking up your personal computer through ordinary telephone lines with a simple device called a modem. This opens up a whole new world of computing, giving you access to information services, electronic newspapers and magazines, computerized "bulletin boards," and fellow hobbyists — next door or across the country. Interested? Here's what you'll need to know to get started.

Harry Blair

TELECOMPUTING TODAY

Tom R. Halfhill, Editor

Telecomputing Articles In This Issue:

Telecomputing Glossary

Commodore's Nationwide Party Line

Commodore Bulletin Boards

MiniTerm-20

TeleTerm 64

Review: VICmodem For VIC And 64

Review: *Terminal 40* For VIC

Coming Next Month

Telegaming Today And Tomorrow

Downloading Games: A Step Toward Telegaming

Many futurists believe that someday telecomputing will be the primary use for home computers – an integral part of every modern household.

You've probably already heard the predictions about home banking, home shopping, "electronic newspapers," telegames, and on-line encyclopedias and data bases. Actually, all of these services are available today, though perhaps not in all areas, or in an affordable or mature form. But times are changing fast.

All of our electronics/communications technologies seem to be merging, moving together toward a common center. Think about it: telephones, television, cable systems, satellite receivers, video cassette recorders, videodiscs, video motion and still cameras, home computers ... everything is evolving toward some kind of "telectronic" supersystem that someday will fuse these now-separate parts into an integrated whole.

Will it really happen within our lifetimes? There are strong indications.

TV sets are starting to come equipped with cable tuners and extra jacks for home computers, videogames, and other accessories. Wide-ranging information services aimed at personal computer users already are accessible with a local phone call in every major city of the United States. Similar systems in Europe are even more advanced. Some cable TV networks and banks in the United States are test-marketing interactive systems using low-cost home computers as terminals. A few of the latest personal computers to be introduced, including those from Atari, Radio Shack, and Osborne, offer built-in phone modems as a standard feature. A new division of Atari, Ataritel, is working on a secret project that will unite home telephone and computer technology in a new way. Some people, instead of commuting to the city, work at home with personal computers or remote terminals tied into their employer's computer over the phone lines. Video cameras are overtaking Super-8 movie cameras in popularity. Still cameras that replace film with magnetic disks and which display their photos on TV sets

Telecomputing Glossary

acoustic-coupled: a type of modem that attaches to a telephone handset with tightly fitting rubber cups over the earpiece and mouthpiece.

ASCII (American Standard Code for Information Interchange): a standardized method of encoding characters (letters, numbers, punctuation, special symbols) into numbers. In telecomputing, all computer output is converted to ASCII numbers for transmission. ASCII translation is a main task of the terminal software.

auto-answer: a feature available on some modems. When hooked up to a phone line and a computer system which is left switched on, an auto-answer modem automatically answers the phone when someone calls and establishes a communications link with the other modem.

auto-dial: another special feature which allows the modem to automatically dial the phone.

baud rate: a measure of transmission/reception speed of a modem. A baud is approximately one bit (binary digit) per second. Eight bits are required for one character. Most home computer modems work at 300 baud, which is about 30 characters per second. A few more expensive modems work at 1200 baud.

BBS (bulletin board system): a computer system with an auto-answer modem that is left switched on during certain hours for public access. The BBS provides some sort of service to callers, such as a message center or a library of programs available for downloading.

will be available in a few months.

Soon, it seems, the entire household will function around this emerging video/computer/telecommunications supersystem – what one futurist has dubbed the "electronic hearth."

For certain, there are social, as well as technological, trends which must be considered. So we'll have to wait and see exactly how things develop. In the meantime, though, this exciting frontier is open to pioneers. It's similar to the groundbreaking days of personal computing five or six years ago.

Telecomputing today is still young. And you can help it grow.

If you're new to the field of telecomputing, you'll quickly discover that it shares something unfortunate with personal computing in general – telecomputing consists of a few easily understood concepts obscured by thickets of thorny terminology.

We'll sort out the terminology in a moment (note the glossary accompanying this article). First, let's review the basic concepts:

1. *Two or more computers can be hooked up to each other with wires.*
2. *With the proper programming, virtually any computers hooked up in this way can exchange virtually any kind of information.*

That's it. Does it seem too simple? Believe it or not, practically everything else you'll ever read or hear about telecomputing consists of extensions (complications) of these two basic concepts.

The "wires" which connect the computers together are usually ordinary telephone lines, just like the ones in your home. (But they don't have to be: it's possible to hook up two computers across a room or within a building using ordinary wires with the right plugs on the end.)

The "proper programming" is often the hard part. The computers may not be normally compatible with each other. However, you probably won't have to worry about this. Programs to cover all the standard situations you're likely to encounter are already written. These programs act as interpreters. They even make it possible for seemingly incompatible computers, such as Commodores, Ataris, Apples, TRS-80s, and others, to communicate as easily as United Nations diplomats.

Now, let's enlarge upon these concepts.

To communicate through ordinary telephone lines, a computer requires a device called a *modem*. "Modem" (rhymes with "load 'em") means "*mo*dulator-*dem*odulator." When two or more computers are communicating over the phone, each computer requires its own modem at its end of the line. The modem is connected between the computer and the phone line, and it allows the computer to send/receive information to/from the other computer.

When you are sending, the modem takes the data in the form of electronic signals from the computer and converts it into audio tones. Then the modem sends the tones through the phone line. These tones, if you hear them, sound like very fast Morse code.

When you are receiving, the modem takes the audio tones sent by the other computer's modem and converts them back into the electronic signals that are understood as data by your computer.

This process may sound familiar. That's because it's very similar to the way the computer saves programs and other data on the cassette recorder. During a SAVE, the computer's output is converted to audio tones which are sent to the recorder and recorded on tape. During a LOAD, the audio tones received from

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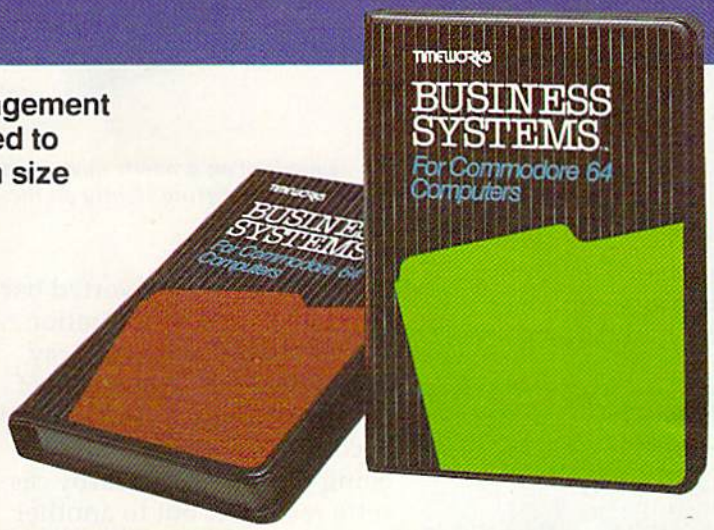

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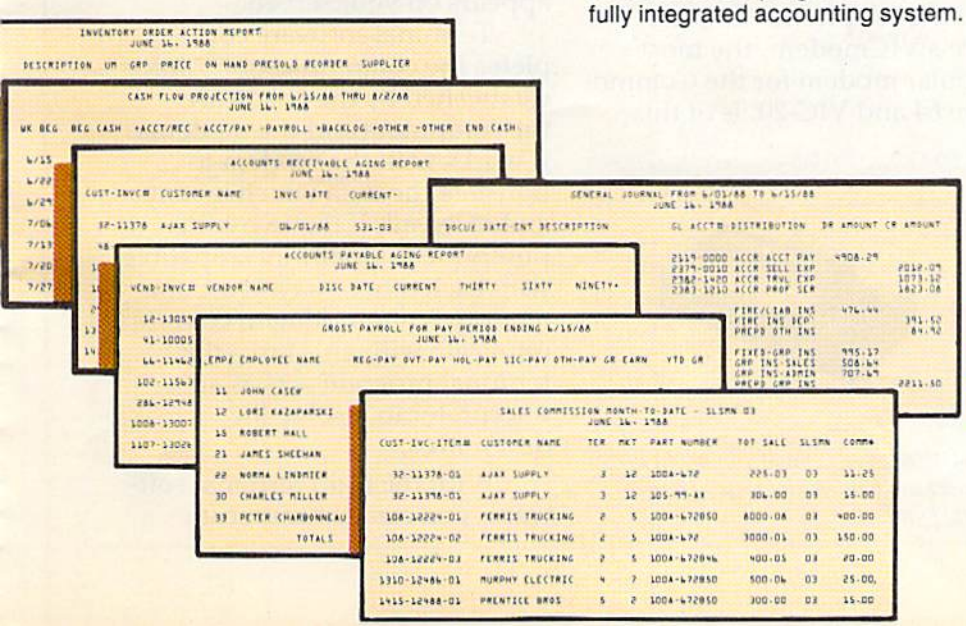
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Bell 103 standard: a communications standard for modems. It refers to modems which can both transmit and receive at rates up to 300 baud. Home computer modems are generally of this type.

buffer: sometimes called a "text buffer" or "file buffer," this is an area of the computer's memory reserved by the terminal program for uploading or downloading files. The buffer must be at least as large as the file being uploaded or downloaded. Can also be used to "capture" any text received from the other computer.

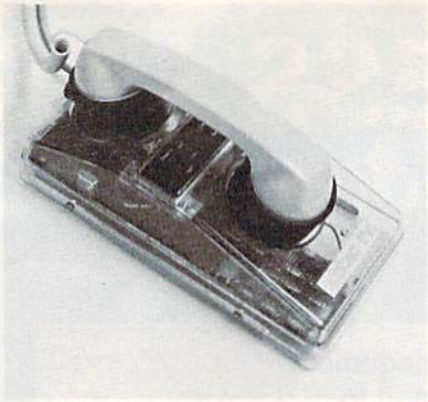
carrier detection: modems indicate they are ready to establish a communications link by transmitting a "carrier signal" over the line. Some modems have an indicator light or beeper which signals the reception of a carrier signal.

direct-connect: a type of modem that attaches directly to a telephone with a modular phone cord, bypassing the handset and avoiding the need of rubber cups.

downloading: opposite of uploading. A terminal software feature which allows receiving a file from another computer with the modem.

duplexing: some modems and terminal programs can be adjusted for "half-duplex" or "full-duplex." This allows you to adjust your system for computers which confirm reception by "echoing" back to your computer all the characters received. Change the duplex adjustment if your screen does not display characters you type, or if it displays two characters for each one you type.

electronic mail: also known as "E-mail." A method of delivering a message to someone via a computer and modem.



An example of an acoustic modem, with its rubber cups fitting tightly on the telephone handset.

the recorder are converted back into the original information. A modem works the same way, except the tones and speed of transmission are different. And, of course, the information is being sent not to a nearby cassette recorder, but to another computer which can be as far away as the furthest telephone.

There are two general types of modems for personal computers: *acoustic* and *direct-connect*. Acoustic modems are easy to spot because they have two rubber cups which fit over the telephone handset's earpiece and mouthpiece (see photo). The rubber cups must fit tightly to keep outside room noises from interfering with the audio tones.

Direct-connect modems do not use rubber cups. Instead, they bypass the handset altogether and connect directly into the telephone. Commodore's VICmodem, the most popular modem for the Commodore 64 and VIC-20, is of this type. The VICmodem is a cartridge that plugs into the rear of the computer, and a cord links it with the telephone (see photo).

The VICmodem is an example of a direct-connect modem – it bypasses the telephone handset.

Direct-connect modems are often preferred to acoustic modems because they are less vulnerable to noise interference. They are the best choice when the modem is operated in a less-than-quiet environment. Until recently, acoustic modems were more popular because of their lower cost. But new technology has made some direct-connect modems less costly than many acoustic models. The VICmodem is widely available for under $100 (see review in this issue).

Equipped with a modem plugged into a telephone, a computer needs only one more thing to be ready for telecommunicating: the "proper programming" mentioned above.

This program is usually referred to as *terminal software*. In effect, it turns your computer into a remote terminal of the distant computer. Your computer is more or less "disabled" as an independent computer and becomes a peripheral or external device of the other computer. Everything you type on your keyboard appears not only on your screen, but on the other computer's screen as well. And everything typed on the other computer's keyboard likewise appears on your screen.

Terminal software completes the communications link established by the hardware – the computers and the modems. It works with the modem to translate the data which is sent and received. If the two computers are normally incompatible with each other – say, if a Commodore is attempting to communicate with an Atari – the terminal program acts as an interpreter to resolve the differences.

With the right terminal software, you can communicate

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THE CONCEPT

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THE GAMES

demanded by such a concept would be unlike common software. They would require machine-language speed, and dungeon-master complexity. Graphics would have to be an integral part of the adventure, rather than pretty but static pictures with no real-time connection to action. They would have both a game-save and character-save feature. And, on whatever machine they were implemented, the software would have to have the same great graphics, the same speed of command interpretation, the same complexity and mind-bending challenge.

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Subscribers to information services can write letters to each other; the letters are delivered to "mailboxes" – computer memory reserved for this purpose – and retrieved the next time the person signs onto the service.

information service: a very large, commercially operated BBS which offers many services to subscribers for an hourly connection fee. Some of these information utilities are aimed at personal computer users.

logging on: the act of establishing a communications link between two computers equipped with modems. Usually, "logging on" refers to linking up with a large mainframe computer, such as those used by universities, businesses, or information services. The opposite of "logging off."

modem (modulator-demodulator): a device which connects between a computer and a telephone to allow the computer to transmit and receive data over ordinary phone lines.

modular phone connections: a standard system of male-female plugs and jacks found on most modern telephone equipment. Direct-connect modems generally require modular connections. If your telephone or wall jacks are more than several years old, you may have to replace them or buy adapters.

remote data base: usually a specialized information service which offers specific types of information to subscribers for an hourly connection fee. Most of these are aimed at professionals instead of personal computer users.

RS-232C interface: a serial-type interface required by some modems to attach to a computer. If the computer with almost any computer. This includes not only other personal computers, but much larger machines as well. College students can program the university's mainframe or minicomputer from their dormitory room, using an inexpensive home computer and modem as a remote terminal. Employees can work at home, accessing their business's computer in the same way. This makes some of the great speed and power of mainframe computers available almost anywhere.

All terminal software is not programmed equally, however. Some terminal programs have features which allow you to do more than others.

One of the most powerful features is *upload/download* capability. This permits you to send and receive files. Files can be anything from written letters to actual programs.

For instance, let's say you want to share a new program you've written with a friend across town or across the country. You could mail the friend a cassette or disk. Or, if you both have modems and the proper terminal software, you could send it by phone. You would call up your friend, establish the telecomputing link by activating your modems, and "upload," or send, the program.

At the other end of the phone line, your friend's computer and modem would be "downloading" the file. Upload/download is like overpass/underpass; it depends upon your point of view. The sender uploads as the receiver downloads.

Usually, the terminal software loads the file off disk at the uploading end before sending it through the modem. At the downloading end, the file is then saved on disk also. It's possible to use a cassette recorder at one or both ends, but the relative slowness of cassettes becomes a big disadvantage, especially when a long-distance phone link is involved.

Exchanging files also requires lots of memory. Each computer must have enough memory to hold both the terminal program and the file. This should be no problem with the Commodore 64, but the VIC-20 needs memory expansion.

Note that even two computers which are normally incompatible can exchange files in this way. An Apple user could upload a message or a program to a Commodore user, for example. But remember, only the phone link has been standardized; the programs remain incompatible. Still, you might be able to modify the program to work, and it would save lots of typing.

What else can you do with a modem?

One popular activity is calling up *bulletin board systems* (BBS). A BBS is a computer with an auto-answer modem that offers some sort of service, either to anyone who calls, or to a select group of people who know the password.

Most bulletin boards are operated by user groups, individual hobbyists, computer shops, or other organizations. A computer is equipped with an auto-answer modem and is left on during certain hours, sometimes 24 hours a day. When you call, the modem automatically answers the phone and sends a steady tone. This signals you to activate your own modem, setting up the link.

Once "on-line," the BBS usually displays a welcoming message and menu of choices on your screen. The choices depend on the BBS. It may be a local user group BBS that offers members the latest news and library programs for downloading. Or it could be a machine-specific BBS with news and programs for users of that particular computer. Some bulletin boards cater to other special interests, such as

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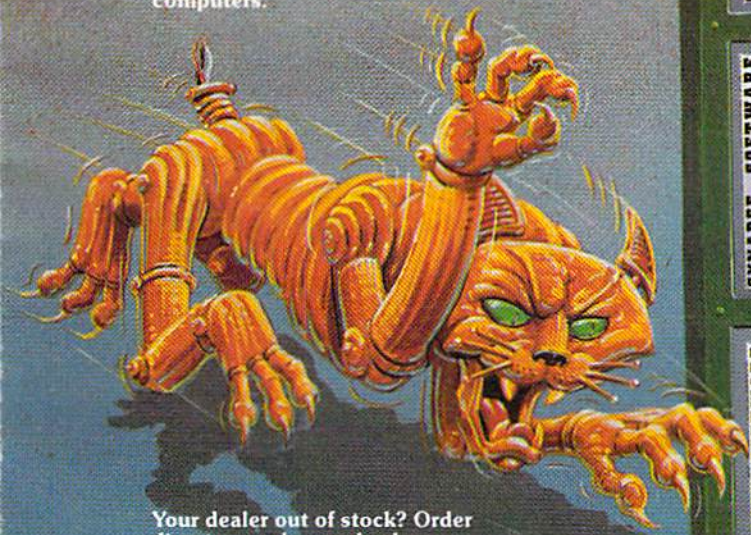

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lacks a built-in interface for a particular modem, a separate interface will have to be purchased to make them compatible.

self-testing: a modem feature which determines if the computer, modem, and telephone are hooked up and communicating correctly. Some modems come with a short program for this purpose.

terminal software: a program necessary to operate a modem with a personal computer. The program makes the computer appear as a remote terminal of the distant computer. Like other software, terminal programs vary widely in the features they incorporate.

uploading: a special feature of some terminal software which allows sending a file from one computer to another with the modem.

amateur radio or science fiction. Many allow you to leave messages for other callers to read. There are even dating services and "X-rated" bulletin boards.

There are also a number of Commodore-oriented bulletin boards. For a listing of phone numbers and hours, see "Commodore Bulletin Boards" in this issue.

Almost all of these bulletin boards are open to virtually anyone. A few, however, require passwords known only to members of a certain organization.

Besides these privately operated boards, there are also commercial information utilities which, in effect, are giant bulletin boards themselves. Instead of operating their systems with small personal computers, these utilities use vast banks of minicomputers and mainframes which allow hundreds of callers to be on-line at a time. They offer wide varieties of services to their subscribers, who pay an hourly connect fee.

Many of these utilities are specialized data bases aimed at business people and professionals such as scientists and lawyers. They can be quite expensive – up to $300 an hour.

The most popular telecomputing utilities for personal computer users are the CompuServe Information Service and The Source. Some others are the Dow Jones Information Service, Delphi (run by General Videotex Corporation), and the Dialog Information Service. Connect fees for these utilities start at about $5 an hour if you call in the evenings or on weekends and holidays. "Prime time" (business hours) costs more.

If you live in a major metropolitan area within the United States, you can usually reach these utilities with a local phone call. The utility leases long-distance phone lines from each area to its central computers, and the phone charges are included in the hourly connect fee. In some smaller cities and rural areas, you'll have to reach the utility through a long-distance network such as Tymnet, whose charges (about $2-$3/hour) are added to the hourly fee.

It would take a whole magazine to list the services offered by the information utilities. There are encyclopedias, newspapers from all over the country, business news and stock reports, Associated Press dispatches, the latest sports scores, marine and aviation weather reports, electronic mail, special interest groups, and even party lines and telegames (see related articles in this issue).

Some modems or terminal programs include a free subscription and some free connect time on one or more of the information utilities (the VICmodem comes with these bonuses). This is an excellent way to find your way around and get acquainted with what's available.

Here are some hints for those who want to get started in telecomputing:

- When choosing a modem and terminal program, be certain they will be compatible with each other and with your computer. Even if the salesperson assures you the combination will work, make sure you can return everything if it doesn't. (The VICmodem comes with its own terminal software for the Commodore 64 and VIC-20.)

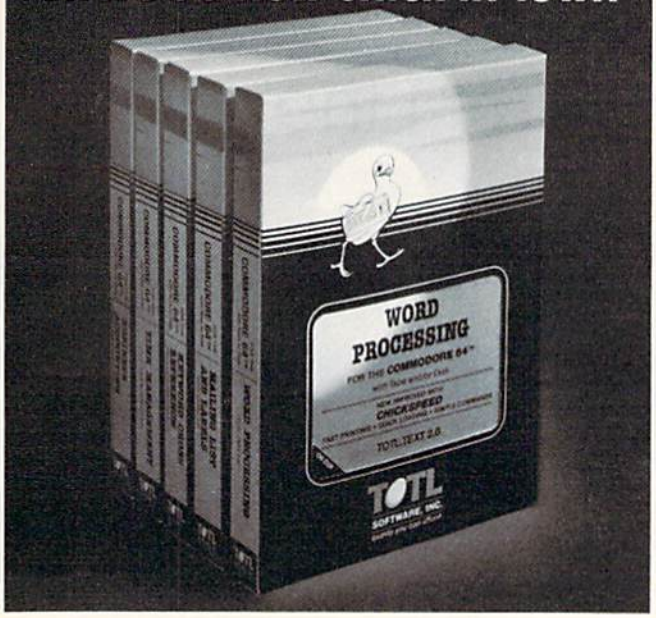
- If you want features such as upload/download, check before you buy. VIC-20 users, especially, should be sure they have enough memory to run the proper terminal software.

- Phone lines can be temperamental. The telephone system is a marvelous thing, but remember, it's a 19th-century invention that was originally designed for voice transmission, not data communications. A good connection is essential for telecomputing. Interference which is unimportant for voice purposes can easily confuse a modem. Unfortunately, telephone companies can be difficult to deal with on these matters. If you suspect a phone line problem, bolster your case by verifying that your computer/modem/software combination works on another line.

- Sometimes you can solve an interference problem by moving the TV away from the modem and telephone. TV sets generate strong magnetic fields.

- If your computer is not near a telephone, you'll have to install an additional phone jack or use a phone extension cord. Try the extension cord first; it's cheaper. But if the additional wire causes interference problems, you may have to resort to another jack.

There's a New Chick in Town



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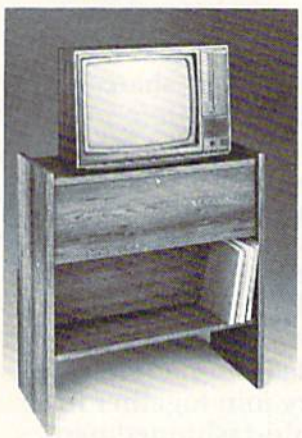

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Reaching Out And Touching Someone In The Computer Age

John Blackford, Assistant Features Editor

Personal computer users love to share ideas, and one way to get together is by *telecomputing* (see "Telecomputing Today," also in this issue). The latest rage is computerized "bulletin boards," through which users can "talk" with each other and leave messages by hooking their computers together over phone lines. Especially popular is a bulletin board sponsored by Commodore on the CompuServe Information Service. It lets Commodore users from all over the country join together in a modern version of the old-fashioned party line.

To get a feel for the Commodore Special Interest Group bulletin board on CompuServe, I signed on for a few evenings and weekends with a Commodore 64 and VICmodem. Unfamiliar with CompuServe, I at first waded through a number of menus that list possible options on the information service. But using the menus to get around is sometimes like taking a slow boat to China – and since you pay by the hour on CompuServe, it saves both time and money to go directly to the section you want. Now when I sign on, I type *GO CBM 6* to jump straight to the Commodore "board." After specifying my computer type (CBM, 64, or VIC), I'm on-line.

There are several options to choose from. You can record a message or read messages already on the board. Some people even leave an address and phone number so others can contact them directly. I left a message that I was writing about the bulletin board and would like to hear from other people.

Within an hour, user Chris Scott had fired off an answer: "How seductive and addictive the SIGs (Special Interest Groups) and bulletin boards are...I'm developing friendships across the nation...."

There's a fine sense of camaraderie on the boards, and users seem more than willing to help each other out with problems. In addition, the bulletin board's system operator (*sysop*), who goes by the name of "Betty Knight," will answer questions, too. You leave messages for the sysop on the Hotline section of the bulletin board. The operator responds by leaving another message, usually within 24 hours.

If anyone responds to your message, the system tells you. This permits long chains of discussion to grow on a particular topic. One user wants to know how to connect a certain type of printer to his Commodore 64, and over the course of a few days a mini-seminar on printers develops,

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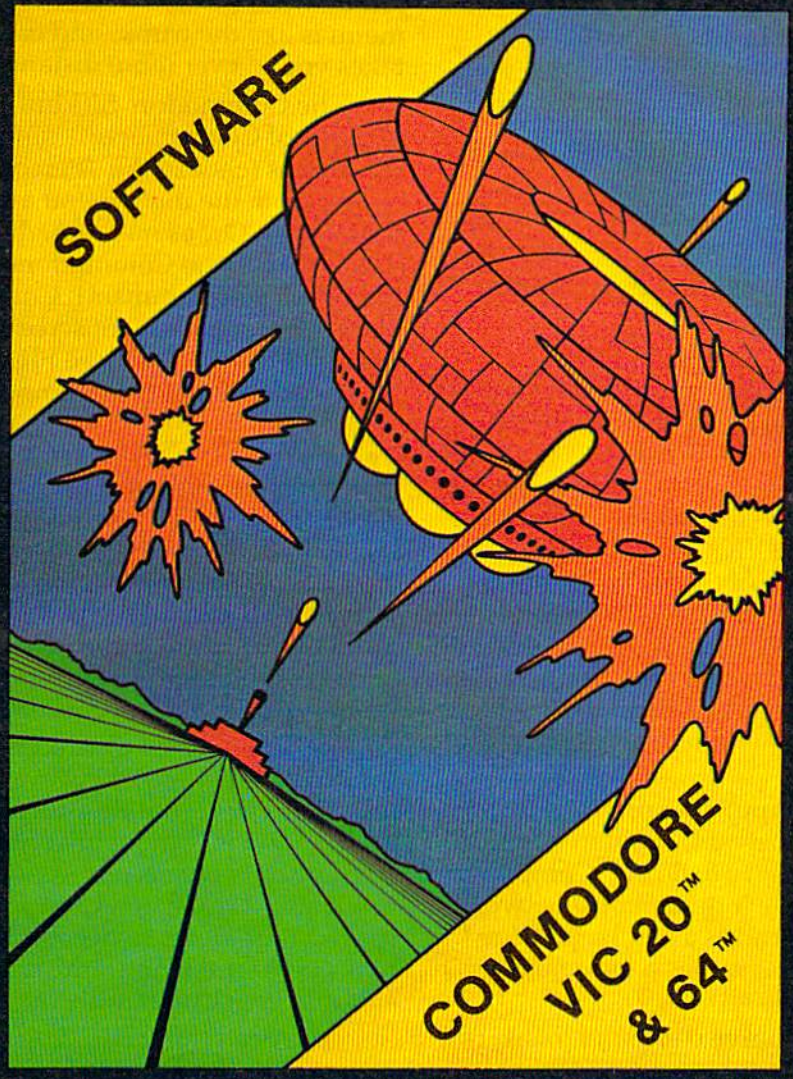

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each message linked to the one before it. Sometimes these discussions remain between two individuals, but often a number of people from all over the country join the circle.

There are plenty of new VIC-20 and Commodore 64 owners looking for help, and many of them are using the bulletin board to compare notes. They are talking about everything: hardware, software, and even whether to visit someone they met on the board. For those who can't wait for a reply, there's even the "realtime" Conference Area that's like a cross-country party line. People talk to each other through their keyboards and screens, forming a nationwide telecomputing "community."

So how can you get on-line with the Commodore "board"? All you need is a modem and a subscription to CompuServe. You get both with the inexpensive VICmodem, which works with the VIC-20 and Commodore 64 (see review in this issue).

A few hints:

First, plug the VICmodem into your computer while the power is off to avoid the possibility of damage. Then power up and load the *VIC-TERM* software that comes with the VICmodem, or one of the terminal programs included in this issue ("MiniTerm-20" for the VIC; "TeleTerm 64" for the Commodore 64). All of these allow you to communicate with CompuServe, The Source, Delphi, other computers equipped with modems, and the scores of other remote bulletin board systems scattered around the continent (a list of some Commodore-oriented bulletin boards follows this article).

Now, dial the CompuServe phone number. This is a local call in most metropolitan areas. In other places, you may have to tie into CompuServe through an intermediate long-distance network such as Tymnet, which adds a surcharge. You can find out if CompuServe has a local number in your area by calling 1-800-848-8199.

When the CompuServe computer answers the phone, you'll hear a high-pitched tone. Unplug the coiled phone cord from the handset (the part you talk into), and plug it into the socket at the back of the modem. Make sure your modem is set to "O" for originate. (If your coiled phone cord doesn't unplug, you'll need a telephone with modular jacks.)

Immediately type a "CONTROL-C" (by holding down the CTRL key while pressing C). *VIC-TERM* and MiniTerm-20 allow you to do the same thing by pressing the f1 special function key. The CompuServe computer should now request your user ID and password, allowing you to log on. The ID and password are part of the VICmodem package, along with an hour of free time on CompuServe. If you don't see the "User ID" prompt within a minute or two, recheck your connections and call again. If you still can't sign on, phone CompuServe's toll-free number for help.

If you've done everything correctly and made the connection, the next thing you'll see is CompuServe's main menu. The main menu gives CompuServe's primary options. Each option leads to further menus, so to reach your destination you follow what's called a "tree" of choices. The main menu is like the trunk, and each additional menu takes you to ever more distant branches.

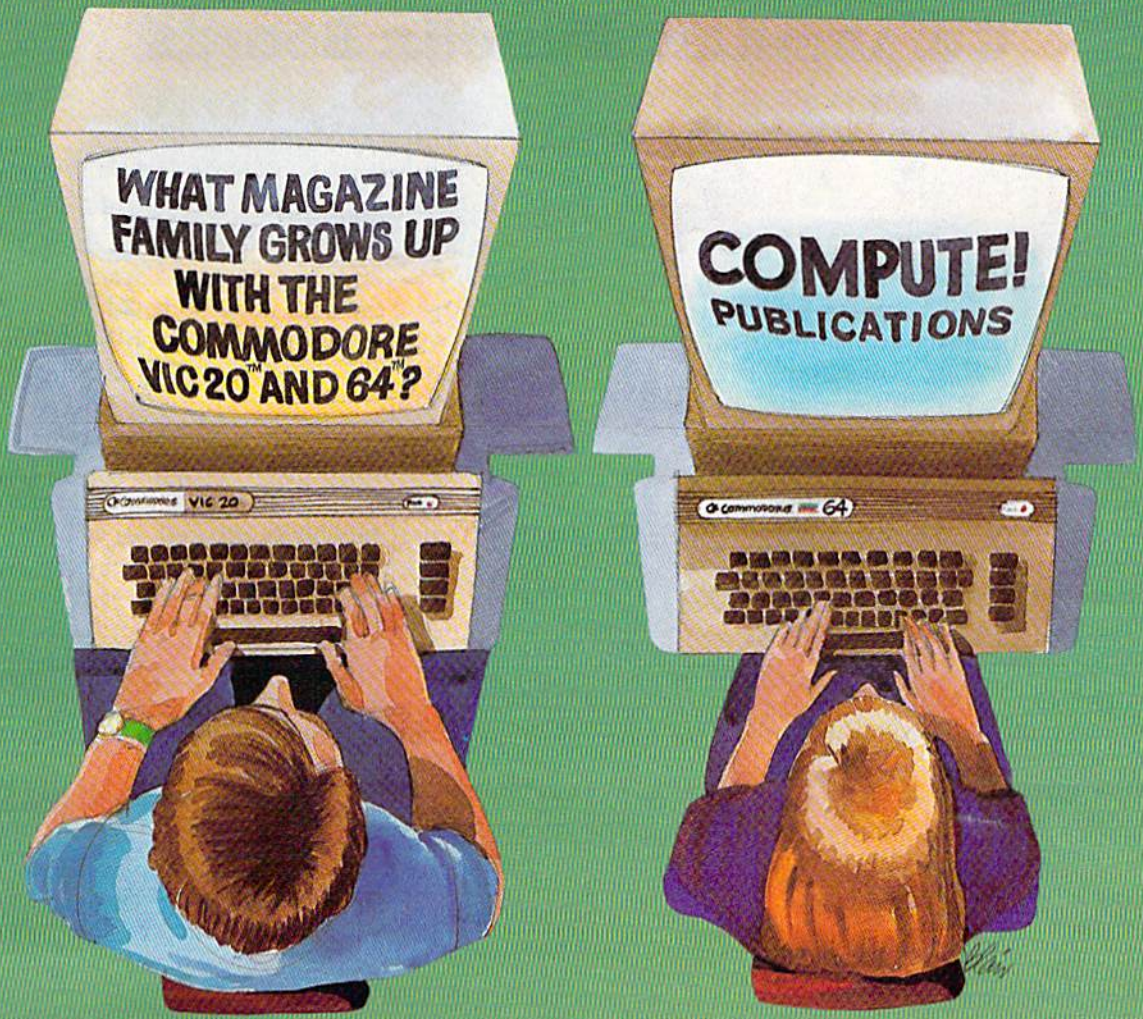
The Commodore SIG bulletin board – as with all parts of CompuServe – can be reached through the menus (choose the "Personal Computing" option from the main menu and follow the instructions). Or, as mentioned before, you can jump right to the Commodore bulletin board with the *GO CBM-6* command. CompuServe is organized into "pages" of screens, and CBM-6 is page 6 of the Commodore SIG – the menu page for the three types of Commodore computers.

When you first enter the SIG of your choice (CBM, 64, or VIC), you'll be greeted with a menu that allows you to leave a message, respond to a message, or read messages. If you elect to read messages, the system will say there are messages numbered, say, 1386 through 3404. You can either page through them one at a time, begin at a certain number, or go to a specific message number.

It's fun the first time on the SIG to page through the list, perusing every message regardless of category. But this does take time, since the information is coming in at only 300 baud (about 30 characters per second, slower than most people can read). Also, when CompuServe is busy, response time slows noticeably – despite the system's powerful mainframe computers, which run simultaneously to handle the load.

To speed things up, you need to learn a little more about the SIG. You can order manuals on the SIGs from CompuServe, and they are worth getting. But while you are on-line, it's easy to find your way through the system by using the instructions on file there, and by using the Help function. For a mini-course on the Commodore SIG, type *G CBM 1* if you are already on the SIG, or *GO CBM 1* when you first sign onto CompuServe. You will see the main CBM menu – which includes the "Introduction to the SIG," a "Survival Kit" on using SIG commands, and the Hotline.

First select option 1 from the menu for the Introduction. When you have a grasp of the basics,



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Commodore Bulletin Boards

Compiled by Kathy Yakal, Editorial Assistant

There are hundreds of computer *bulletin board systems* (BBS) in North America. Most of them are operated by user groups or hobbyists who hook up a personal computer to an auto-answer modem. When you call the BBS, the modem answers with a tone, signaling you to switch your own computer "on-line." Then, depending on the BBS, there are all kinds of things you can do. Some bulletin boards offer the latest news or gossip on a certain topic; others even make it possible for callers to download programs for free. There is a BBS for almost any interest.

By using a modem with your Commodore 64 or VIC-20, you can gain access to most of these bulletin boards. In addition, there are many Commodore-oriented bulletin boards. They allow you to download programs for Commodore computers and to distribute news and information of special interest to Commodore owners. Here is a list of some of them. If you know of a Commodore BBS that has been omitted, or of one which is just starting up, please let us know. They will be listed in a future issue.

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(303) 223-4305
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Commodore Public Bulletin Board System (Chicago)
(312) 397-0871
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Video King (Chicago)
(312) 674-6502
24 hours a day, 7 days a week.

INDIANA
AVC Computer Center Bulletin Board (Indianapolis)
(317) 255-5435
24 hours a day, 7 days a week.

MASSACHUSETTS
MASSPET Bulletin Board (Boston)
(617) 824-4878
7 p.m. – 9 a.m. Monday through Friday, 24 hours on weekends.

MISSOURI
Commodore Communications (St. Louis)
(314) 625-4576
24 hours a day, 7 days a week.

Kansas City PET User Group Bulletin Board
(816) 257-2502
24 hours a day, 7 days a week.

TEXAS
RPCC
(214) 996-6808
24 hours a day, 7 days a week.

UTAH
Commodore Utah Bulletin Board (Salt Lake City)
(801) 277-3913
24 hours a day, 7 days a week.

WASHINGTON
Northwest Commodore User Group Bulletin Board (Edmonds)
(206) 743-6021
24 hours a day, 7 days a week.

WISCONSIN
C.U.S.S.H. (Racine)
(414) 554-9520
24 hours a day, 7 days a week.

WYOMING
Southeast Wyoming Commodore Bulletin Board
(307) 637-6045
24 hours a day, 7 days a week.

CANADA
ASC Microsystems Bulletin Board (Thunder Bay, Ontario)
(807) 345-7199
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9 p.m. – 8:30 a.m. Thursday through Friday;
24 hours on weekends and holidays.

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PSI Word Pro Bulletin Board (Toronto, Ontario)
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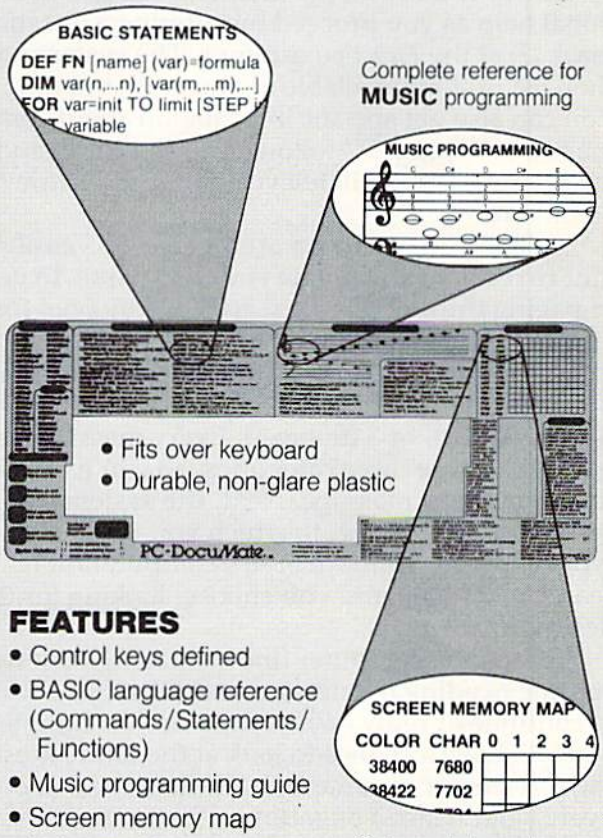

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return to the menu and choose option 2, Survival Kit, which is another menu. Select option 3 from that menu for an explanation of the bulletin board. You can run through these sections in about half an hour, and you'll save many times that after only a session or two.

One of the first things you'll notice when using the system is that there are two sets of commands, one for the main area of CompuServe and another for the Commodore SIG. CompuServe prompts you to enter a command with an exclamation point (!), while the SIG prompts you by printing *Function:* on your screen. You don't need the CompuServe commands to use the bulletin board, other than the *GO* command to get to the SIG.

Once you are on the SIG, you can get additional help as you proceed by entering a question mark (?) at the *Function:* prompt. The system will then list options available to you at that point. You can also get specific information about commands by typing "?" followed by the command – for example "?R" will tell you about the Retrieve command.

When you can move around the SIG easily, you're ready to streamline your technique. Instead of paging through the messages one by one, for example, you can search them selectively by typing *SF* for Search Forward. When the system prompts *Search Field:*, you respond with either *F* (From), *T* (To), or *S* (Subject). Every message begins with those three categories, so you'll be able to search every message. Next, the system prompts *Search String*, to which you respond by typing a word. CompuServe's computer then searches the category you choose, looking for the desired word.

When the computer finds a match, it shows you the heading in question and asks if you want to continue or reply. When the search is complete, you will have a chance to look at the entire message. A similar command is *RS*, Retrieve Selectively – but instead of getting only the headers, you'll get the entire message each time the computer finds a match. With these two commands, you can retrieve messages of interest to you without having to waste a lot of time looking through the entire list.

The CompuServe subscription that comes with the VICmodem is only temporary, and you can use up your free hour of connect time pretty fast if you spend much time exploring the Commodore bulletin board and other CompuServe offerings.

When your free hour on CompuServe is used up, you can subscribe permanently at no extra charge. When you first log onto CompuServe, you'll be asked either to sign up permanently (option 1) or go directly to the main menu (option 2). Option 1 immediately gives you two more hours with your current password – at the normal charge of $5 per hour. After signing up, you'll get a new password and ID number in a couple of weeks.

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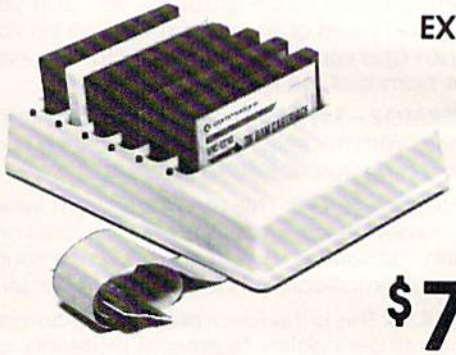

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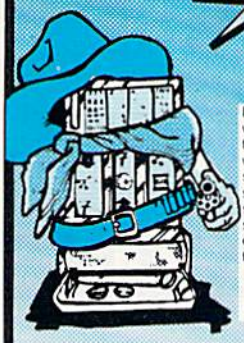

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POKEing Graphics

In my first column, I discussed PRINTing graphics. Another way to put graphics or text on the screen is to use the POKE command. This method is especially useful in animation.

The format for the POKE command is POKE n1,n2 where n1 is a memory address and n2 is a numeric value. Some POKE commands are used for music and sound, as discusssed last month. If we use different address numbers, the POKE will not create sound but will have another function.

First, let's try POKE 36879,n2 where n2 can be a number from 8 to 255 (with a few missing numbers in between). This POKE command will change the screen and border colors on the VIC-20. The chart on page 134 in your manual, *Personal Computing on the VIC-20*, tells what value to POKE to get different results. On the Commodore 64, you type POKE 53280,n2 to change the border color, and POKE 53281,n2 to change the screen color, where n2 is any number from 0 to 15.

Let's try a few:

For the VIC 20	For the 64
POKE 36879,78	POKE 53281,12
POKE 36879,15	POKE 53280,1

To get back to normal, just press RUN/STOP and RESTORE, or type POKE 36879,27 on the VIC. On the 64, POKE 53280,14 and POKE 53281,6.

Here is a program to see all the combinations:

VIC Version

```
10 FOR I=8 TO 248 STEP 16
12 FOR J=I TO I+7
14 POKE 36879,J
16 FOR D=1 TO 200:NEXT D
18 NEXT J,I
20 POKE 36879,27
```

64 Version

```
10 FOR I=0 TO 15
15 POKE 53281,I :REM SET SCREEN COLOR
20 FOR J=0 TO 15
30 POKE 53280,J :REM SET BORDER COLOR
40 FOR D=1 TO 200:NEXT D
50 NEXT J,I
```

Simple Graphics

Now let's put some graphics on the screen. You'll have to have your manual handy. For the VIC, look at page 144. For the 64, turn to page 138.

For the VIC, the upper rectangle represents the screen of 23 rows by 22 columns; for the 64, the block represents the screen of 25 rows by 40 columns. Each location number is obtained by adding the row and column numbers. This is the n1 number you need for the POKE location. For example, to POKE to row 10, column 4, we would use an n1 of 7878 + 4 = 7882 for the VIC, and an n1 of 1384 + 4 = 1388 for the 64.

Refer to pages 141-142 in the VIC-20 manual, or pages 132-134 in the 64 manual for a chart of character codes for the n2 number in the POKE command. Look under the SET1 column heading for a symbol you want to print. Find the corresponding number in the POKE column. For example, to draw a spade, the number is 65.

You now have the parameters for a POKE command in graphics. Let's put a spade in row 10, column 4. We know that the command on the VIC is POKE 7882,65 and on the 64 it is POKE 1388,65.

The only problem is that when you draw graphics this way, you won't be able to see them (except on a small number of 64s). This is because the graphics character you POKEd in is the same color as the screen "background," which makes the character impossible to see. One solution is to

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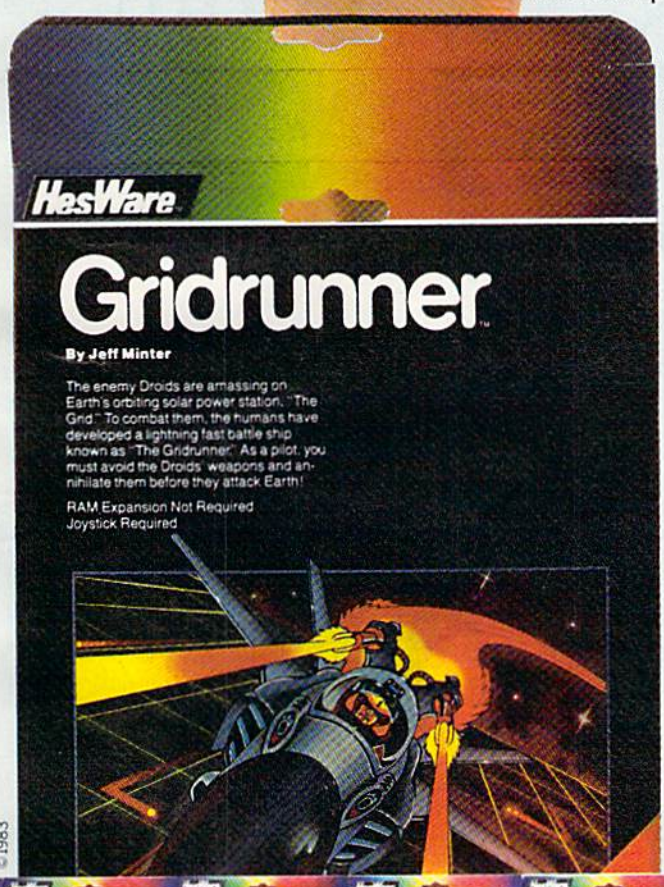
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change the screen color after POKEing in the graphics.

For example:

VIC Version

```
10 PRINT"{CLR}"
20 POKE 7882,65 : REM DRAWS WHITE SPADE
30 POKE 36879,47 : REM CHANGES SCREEN CO
   LOR TO RED
40 GOTO 40
```

64 Version

```
10 PRINT"{CLR}"
20 POKE 1388,65 : REM DRAWS SPADE
30 POKE 53281,1 : REM CHANGES SCREEN COL
   OR TO WHITE
40 GOTO 40
```

Press the RUN/STOP key to stop the program. Press RUN/STOP and RESTORE at the same time to return to the "normal" screen colors.

Changing Colors

Suppose you like your regular colored screen and want to draw graphics. You can change the color of your character by POKEing a memory location with a color code. Refer to your manual again – bottom of page 144 for the VIC, bottom of page 139 for the 64. You will find a color codes memory map. Each screen location has a number (obtained by adding the row and column numbers shown) for keeping track of color; this will be our n1 number for our color POKE. The color codes are listed on page 143 for the VIC, and at the top of page 139 for the 64. This color code will be our n2 number for our color POKE.

For example, let's use our same spade on row 10, column 4. Find the color memory number corresponding with screen location 7882 on the VIC, and 1388 on the 64. Counting 10 rows down, you should see a 38598 in the VIC-20 manual and a 55656 in the 64 guide. Adding 4, we get 38602 for the VIC, and 55660 for the 64. Note that the difference between corresponding screen and color locations will always be 30720 and 54272 for the VIC and 64 respectively.

So, to put a red spade on the screen, we could use this program:

VIC Version

```
10 PRINT"{CLR}"
20 POKE 7882,65
30 POKE 38602,2
```

64 Version

```
10 PRINT"{CLR}"
20 POKE 1388,65
30 POKE 55660,2
```

You can flash an object by changing the color codes. Try the following program:

VIC Version

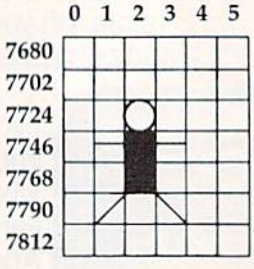
```
10 PRINT"{CLR}"
20 POKE 7882,65
25 FOR C=1 TO 20
26 FOR D=1 TO 100: NEXT D
28 POKE 38602,1
29 FOR D=1 TO 100: NEXT D
30 POKE 38602,2
35 NEXT C
```

64 Version

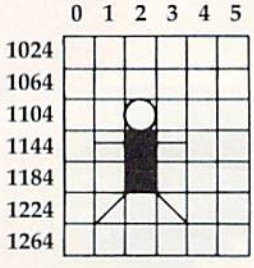
```
10 PRINT"{CLR}"
20 POKE 1388,65
25 FOR C=1 TO 20
26 POKE 55660,6
27 FOR D=1 TO 100:NEXT D
28 POKE 55660,1
29 FOR D=1 TO 100:NEXT D
35 NEXT C
```

You are now ready to sketch a design of your own and then POKE values to draw your picture. Here is a sample program:

VIC Version



64 Version



VIC Version

```
10 PRINT"{CLR}"
12 L = 30720
14 POKE 7726,87:POKE7726+L,2
16 POKE 7748,102:POKE7748+L,6
18 POKE 7770,102:POKE7770+L,6
20 POKE 7747,64:POKE7747+L,6
22 POKE 7749,64:POKE7749+L,6
24 POKE 7791,78:POKE7791+L,6
26 POKE 7793,77:POKE7793+L,6
28 GOTO 28
```

64 Version

```
5 POKE 53281,1:REM WHITE SCREEN
10 PRINT"{CLR}"
12 L = 54272
14 POKE 1106,87:POKE1106+L,2
16 POKE 1146,102:POKE1146+L,6
18 POKE 1186,102:POKE1186+L,6
20 POKE 1145,64:POKE1145+L,6
22 POKE 1147,64:POKE1147+L,6
24 POKE 1225,78:POKE1225+L,6
26 POKE 1227,77:POKE1227+L,6
28 GOTO 28
```

To try animation, change the graphics by POKEing different characters or by drawing and erasing characters to move the graphics. Change the above program by adding the following lines – can our guy fly?

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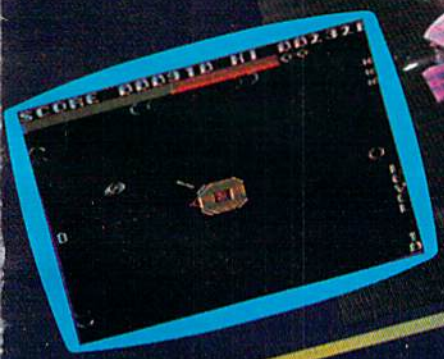
Created by Alan Pavlish



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VIC Version

```
28 FOR I=1 TO 50
30 POKE 7747,99
32 POKE 7749,99
34 POKE 7747,64
36 POKE 7749,64
38 NEXT I
40 GOTO 40
```

64 Version

```
28 FOR I=1 TO 50
30 POKE 1145,99
32 POKE 1147,99
34 POKE 1145,64
36 POKE 1147,64
38 NEXT I
40 GOTO 40
```

The Character Sets

Two character sets are available for graphics, but only one set can be on the screen at a time. You probably have discovered that if you have some printing on the screen and you press the COMMODORE key and the SHIFT key at the same time, all capital letters change to lowercase letters. The first condition is Character Set 1, and the second condition is Character Set 2.

Before you start drawing your graphics, POKE 36869,242 will change to the lowercase mode, or Set 2 on the VIC. To return to Set 1, use POKE 36869,240. On the 64, POKE 53272,23 will put you in Set 2, and POKE 53272,21 will put you back in Set 1. Note that the values to do this that are listed on page 132 of the 64 manual are not correct.

Reverse characters are also available. The reverse of any character on the chart is calculated by adding 128 to the number in the chart.

You can use the PEEK command to see what character is in a particular location or what the color is. You can use the PEEK command to detect a barrier or to detect a crash in a game. PEEK(n) will return the value in memory location n. Some valid commands are:

```
PRINT PEEK(7911)
200 IF PEEK(A)=32 THEN 350
```

At first, PEEK doesn't seem to work with color memory, since when you PEEK it, you get a different number than you POKEd in. To fix this just use:

```
X=PEEK(n) AND 15
```

instead of:

```
X=PEEK(n)
```

You only have to do this when n is in color memory.

To further demonstrate POKEing graphics, let's look at a couple of sample programs. In Programs 1 and 2, I and J are coordinates to determine the location of the ball. The ball bounces within the boundaries.

Graphics In A Game

Programs 3 and 4 illustrate how you can POKE graphics and create moving graphics for a game. "Defend" is a shooting game for one person. You are positioned on the left of the screen and need to defend your territory – don't let the invader coming from the right of the screen get to your border.

Line up horizontally with an invader by pressing ↑ to move up and CRSR ↑ to go down, then shoot by pressing either the space bar or the F7 key. You score ten points for each invader you successfully shoot, but you lose five points if you miss.

After you have played this game once or twice, change it into your own game. Use different graphics and colors. Change the motion to vertical instead of horizontal. Change the scoring. After you reach certain scores, perhaps you could change the shapes of the invaders and vary their speed.

The following description is for the VIC version of the program. It is almost perfectly accurate for the 64 version as well: the major differences are that all sound commands have been removed from the 64 version, and that certain POKEs to color memory have been added that are required by the 64, but not by the VIC.

VIC Program Description

Lines	Explanation
1	Turn on the volume for sound; initialize TS for the top score.
2	Define function R(X) to calculate the location number for a random row; branch to line 200.
10	Clear screen; set screen and border color. Initialize variables. N is the location of your ship, SC is the score, and D is difficulty level.
20	Place defending ship on screen.
22-25	Randomly place invaders, making sure invaders are not on the same row as the player.
30	Detect which key is pressed. If it is one of the firing keys, branch to line 60.
32-34	If arrow keys are pressed, move up or down.
35	Increment L to determine speed of invaders.
36	Increment invaders' positions; move one spot to the left.
37-42	If an invader reaches left side of screen, branch to line 100 to end game.
44-50	Move invaders; branch back to receive next key press.
60	Make firing noise and blink defender.
62-68	Check positions of invaders to see if one was shot.
70	Decrease score by five if shot missed.
72-78	Procedure if invader is shot; choose new invader position.
80	Increase score by ten; clear invader; stop noise.
82-84	Print score and branch back for next key press.
90-94	Check boundary position of defender, then draw defender on screen in new position.
100-110	Procedure at game's end.
120-160	Print ending message, score, and high score.
170-190	Print option to try again and branch appropriately.
200-280	Print instruction screen.
290	END.

See program listings on page 120.

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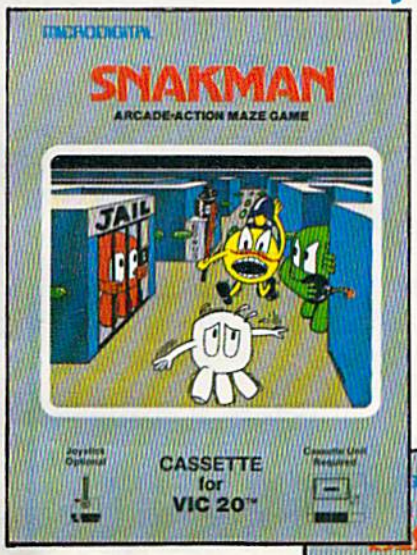

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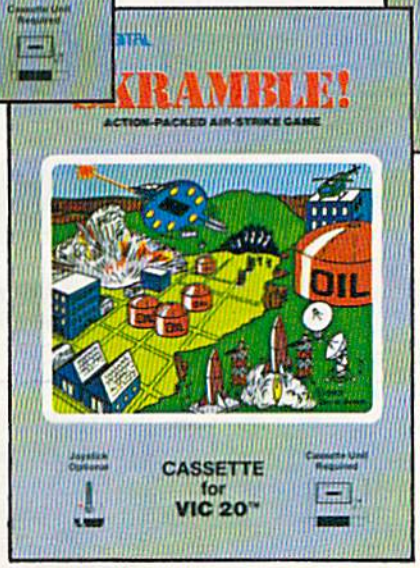

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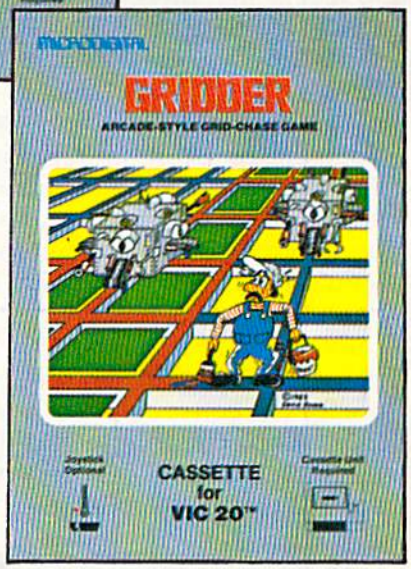

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MACHINE LANGUAGE FOR BEGINNERS

RICHARD MANSFIELD, SENIOR EDITOR

DISASSEMBLING

Program 1, a *disassembler*, is one of two major tools you'll be using when you work with machine language. In order to understand what it does, we'll first need to look briefly at the other major tool, an *assembler*.

An assembler is used to write an ML (machine language) program in the same way that BASIC is used to write a BASIC program. An assembler lets you type in ML instructions like LDA #8 and then translates the instruction into numbers and POKEs them into memory for you. Take a look at Program 3. The first line, numbered 884, says LDA (LoaD the Accumulator) with the number eight. This same instruction appears in different form in line 882 of Program 2: DATA 169,8. An assembler would translate your LDA instruction into the number 169. If you're just starting out with ML, these instructions won't mean much to you yet, but for now all we want to do is get a feel for the broad concepts of ML.

To look at "assembling" another way, it helps to realize that there's a similar process going on when you write a BASIC program. After you type in a BASIC command, the BASIC interpreter translates it into a "token," a single-byte representation of the command, and stores the token in memory. So, a line of BASIC is stored inside the computer in a different form than you would see on the screen when you type it in. The *word* "LIST" would be stored in four bytes, but the command LIST would be crunched down by BASIC into only one byte. Similarly, an assembler takes your LDA and turns it into the number 169, which can be stored in a single byte. These words – LDA and LIST – are for our convenience. They are easier for us to work with. The computer only needs numbers and so BASIC and its ML equivalent, an assembler, accepts the words, but stores numbers.

An Understandable Version

Of course, you need to go the opposite way sometimes, to go from the numbers back to the words. If the computer stores, interprets, and executes programs as pure numbers, how can we examine or modify a program? We don't want to study a list of numbers, however efficient they are for the computer's internal use (see Program 2). Program 1, a disassembler, does for ML what the LIST command does for BASIC programs. It takes a look at a compressed, numeric, machine-readable program in memory and prints out an understandable, human-readable version.

Last month we created a short ML program, *RAMtest*, which put every possible number (0 through 255) into every memory cell in your computer's RAM memory. A fragment of that program appears in Programs 2 and 3 here. If you type in and SAVE Program 1, then type in and RUN Program 2, you can LOAD in Program 1 again and, when the disassembler asks you for START ADDRESS, type 884. That's the address where the fragment starts in RAM memory. You'll then see your screen fill with the disassembly of the ML fragment (Program 3).

At this point, you will probably find it difficult to understand this disassembly listing. As you begin to learn the meaning of ML instructions, however, the purpose of this fragment will become clear. As a quick explanation: line 898 copies a number from the "accumulator" into a cell in RAM memory. Then line 900 compares the RAM memory cell against the accumulator. If they are the same (BEQ means Branch if EQual), then we are sent down to lines 925 and 926 where the number in the accumulator is raised by one. We go back and test the same cell over and over, raising the number each time so we can see if that cell will hold all the possible numbers.

Just the way that IF/THEN tests in BASIC, if we had a bad memory cell and the number was found to be not equal in line 900, we would "fall through" the BEQ to line 904 which would print out an error message on the screen to alert us about the bad memory. By the way, we've been calling the numbers on the left side of Program 3 "line numbers." In fact, they're memory addresses where the instructions were found in RAM. It's useful, though, to think of them as similar to BASIC's line numbers. They serve the same purpose.

Don't be concerned if this is difficult to follow. We're jumping into ML to get our feet wet. It's

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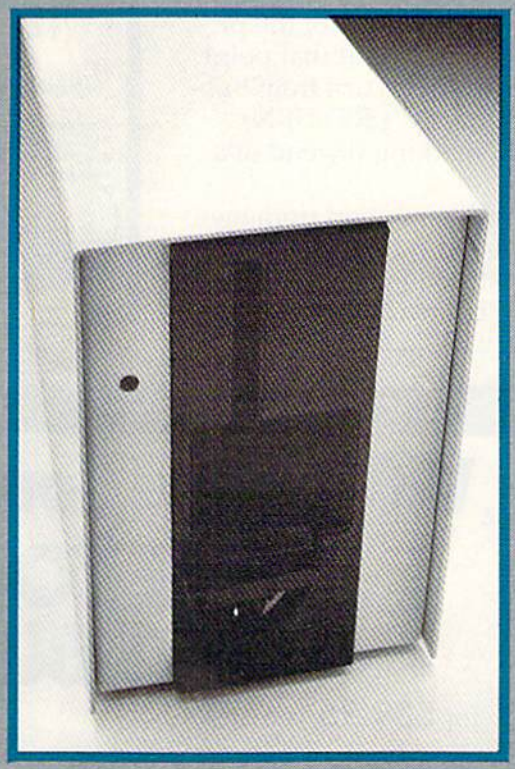

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likely that you learned BASIC the way I did: by working with the language and making lots of mistakes and not fully understanding what was going on at first. So we'll plunge into ML by starting off with the main tools, the assembler and the disassembler. You won't be able to use them with very much skill to begin with, but just working with them is probably the fastest way to learn. After we've explored disassembling a bit, we'll go on to work with an assembler in an upcoming issue.

Trying It Out

We can conclude with a few comments about the disassembler. There are several graphics features of this disassembler which can make it easier to visualize the programs it disassembles. All branching instructions (like BEQ), JSRs, and JMPs (the equivalents of GOSUB and JUMP) are offset on the screen to indicate that the flow of the program might be taking a new course at that point. Likewise, the RTS instruction (ReTurn from Subroutine, the equivalent of BASIC's RETURN) causes a line to be drawn, marking the end of a subroutine.

Line 210 PEEKs the ML command from memory. If it cannot make a match against the array containing all legal ML instructions (lines 820-960), a "?" is printed on screen in line 230. When you see a series of question marks during a disassembly, it means that you are not disassembling an ML program, but rather have come across a "data table." This would be a list of names or words which might be *used* by an ML program, but is not actually ML code.

You can use the disassembler to look into the heart of your BASIC language. Just give an address between 40960-49151 as the START ADDRESS for the 64 (between 49152-57343 for the VIC), and you can see the insides of one of the most complex ML programs ever written: your BASIC. Next month we'll learn how to go directly into BASIC and access some of its ML subroutines.

See program listings on page 121.

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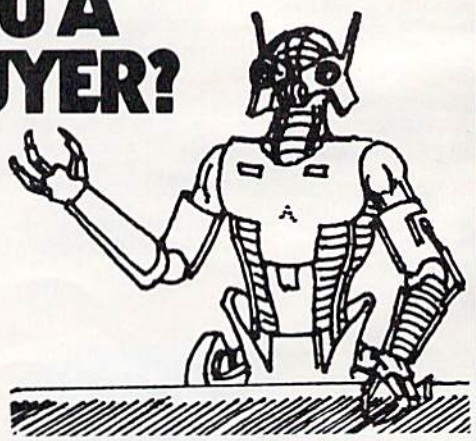

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INNOVATORS IN DIGITAL COMMUNICATION

News From The Summer CES

More Software, Lower Prices

Tom R. Halfhill, Editor

The Summer Consumer Electronics Show (CES) is one of the largest trade shows in the world. A showplace for everything from video recorders and stereos to videogames and personal computers, it annually attracts about 100,000 industry retailers and distributors who try to decide what the public wants to buy in the coming year. Here's a report on the latest developments that affect owners and users of Commodore computers.

This summer's Consumer Electronics Show, held in Chicago in June, was the biggest ever for the personal computer industry.

It was so big, in fact, that almost all of the videogame and computer exhibits had to be housed in their own building down the street from the main convention hall. Floor space was as dear as Manhattan real estate. And many of the elaborate exhibits cost as much as Silicon Valley housing.

During the four-day show, nearly a score of new personal computers selling for under $1000 were introduced. Coleco shook up the industry by announcing a package that includes a computer with 80K of memory, detachable keyboard, high-speed tape drive for mass storage, letter-quality printer, game controllers with numeric keypads, word processing software, and an arcade-style game – complete for $600. What's more, it plays all ColecoVision game machine cartridges and will be available in a version that costs only $450 for those who already have a ColecoVision to plug it into.

Atari, Inc., also attracted attention with its completely new line of four XL series computers, ranging from $199 for a 16K model to about $1000 for a 64K machine with built-in modem, speech synthesizer, and double-sided/double-density disk drive.

But although shiny new hardware wins the most glamour appeal, some really significant news at the show was related to software – especially for Commodore users.

Commodore showed no new computers at CES, but did announce the largest single software introduction in the history of the company: more than 70 programs for the Commodore 64 and VIC-20. The bulk of these programs are the result of a recently formed software division at Commodore which has been charged with strengthening the company's software support, often exploited as a weakness by competitors.

Of even greater significance, Commodore is beginning to push home computer software in the same way it has succeeded in mass-marketing home computer hardware – by drastically slashing retail prices. Cuts of up to 50 percent were announced.

"We broke price barriers with the VIC-20 and Commodore 64, and now we're doing the same thing with software," said Sig Hartmann, president of the new division. "We want everyone to know that Commodore's in the software business."

They're not alone, however. In another important move, Atari formed a new subsidiary, Atari Publishing, to sell hit Atari computer games for competing computers – including the VIC-20 and Commodore 64.

Taken together, these developments mean that software for the industry's most popular home computers – the VIC and 64 – should be increasingly plentiful and affordable. The summer of 1983 may mark the turning point in home computer software, much as the summer of 1982 did for hardware.

FROM AdVENTURES

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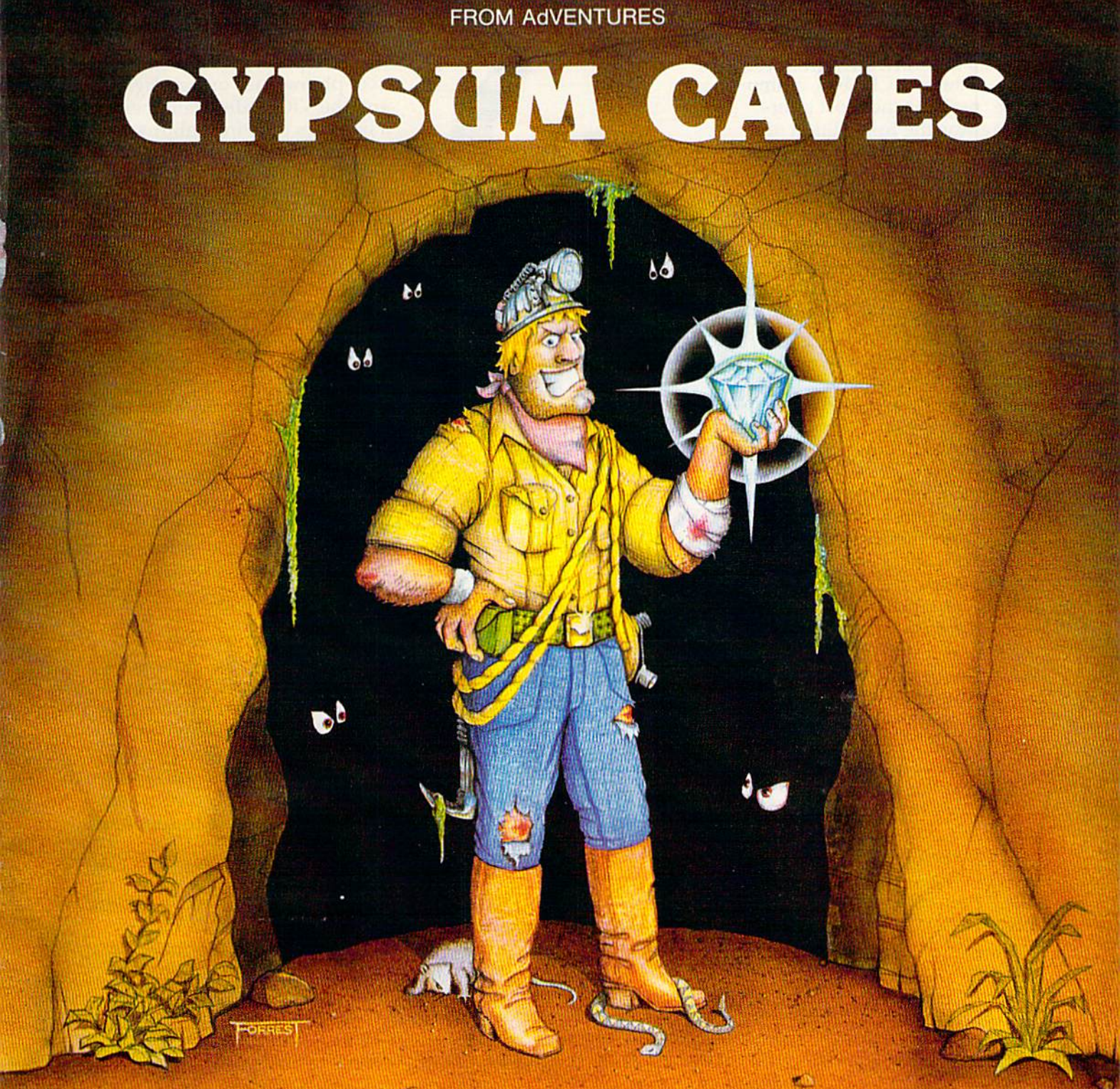

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Gypsum Caves is the new computer challenge from AdVENTURES. More than just another 2 minute shoot-'em-up, Gypsum Caves requires timing, common sense, and concentration. One game may last hours or even days.

The player attempts to negotiate the twists and turns of the caves, using objects found along the way to traverse the obstacles and solve the riddles leading to the mysterious final room. Color graphics and sound complete the experience.

Gypsum Caves
by Brian Wagner

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Of all the software introduced at the Summer CES by Commodore, perhaps the most interesting was the first edition of the new *Magic Desk* series for the Commodore 64.

Magic Desk I – Type and File is a cartridge described by one Commodore representative as "Commodore's answer to Apple's Lisa." Lisa, of course, is Apple's $10,000 business computer that comes with a series of programs integrated to an unprecedented degree, controlled by a tabletop "mouse" device that reduces keystrokes to a minimum. *Magic Desk* is an economy version of the same concept, designed and priced for home users instead of well-heeled businessmen.

Magic Desk I, *the Commodore 64's answer to Apple's Lisa.*

When the computer is switched on, the main screen displays a "menu" of choices, as do thousands of other programs – except the *Magic Desk* menu is a color picture of an office. Inside the office is a desk with a typewriter, index file, telephone, calculator, and financial journal. Beneath the desk is a wastebasket. There's also an artist's easel sitting nearby, and a vertical file cabinet with a digital clock on top. Floating in the air above all this is a hand with a pointing finger. The hand can be moved all over the screen with a joystick.

To select a menu option, you point to the corresponding object with the finger. Pressing the joystick trigger button then loads the appropriate program off disk.

For example, pointing to the typewriter selects a typewriter-like word processing program. The screen clears to a white sheet of "paper," and a typewriter carriage with paper guides, margin stops, and a moving striker for a cursor appears. (The word processor is so much like a typewriter that you must even hit RETURN at the end of each screen line.) After writing a document, you can return to the main screen by pointing the finger at another symbol. Once back at the desk, you can delete a file by throwing it in the wastebasket, or store it away for future reference by pointing to the file index or cabinet. You can retrieve files from the cabinet with the floating hand, stick them in the typewriter, and edit or rewrite them. By opening a file drawer, you can search through files, sort them, rearrange them, and so on.

While *Magic Desk I* supports the typing and filing functions, additional programs in the series would have to be purchased to take advantage of all the features portrayed by symbols in the "office." The next cartridge will include calculating and home budgeting. The telephone and artist's easel raise some fascinating possibilities – maybe it will be possible to transfer files over phone lines using *Magic Desk* and the VICmodem, and perhaps a graphics drawing subprogram will be added in the future. Interestingly, the symbols themselves can be redefined to provide even more functions. For example, the file index could be reprogrammed as alphabet blocks to symbolize an educational program, or as a guitar to represent a music program.

The *Magic Desk* cartridge, which contains 32K of Read Only Memory (ROM), will be priced at under $100. Commodore says it is scheduled for delivery by early fall.

Like *Magic Desk*, most of the other new Commodore software also is for the 64, though the VIC-20 wasn't ignored, either. The 64 software is priced substantially under $100, and the VIC software under $30. All of it was promised for delivery within 60 days, which means it should be available by the time this issue appears.

As an indicator of the new low prices, each package in the "Easy Software Series" for the 64 will sell for under $50. This includes *EasyScript 64*, the long-awaited word processor which incorporates the best features of Professional Software's *WordPro*; *EasyCalc 64*, a cartridge-based spreadsheet; *EasyFinance I* through *EasyFinance V*, a series of small business programs; and *Easy Codewriter*, a utility that allows nonprogrammers to generate their own filing programs.

Other programs shown for the Commodore 64:

- Seven business programs on disk, including *The Manager* (a data base system), *MultiPlan* (a spreadsheet for CP/M), *General Ledger, Accounts Receivable/Billing, Accounts Payable/Checkwriting, Inventory Management*, and *Payroll*. Selling these packages for under $100 is a real breakthrough, especially since programs such as *MultiPlan* cost several times that much on competing systems.
- Six adventure games on disk, including the popular *Zork* series, plus *Starcross, Suspended*, and *Deadline*.
- *Wizard of Wor* on cartridge, the first talking game for the speech module introduced at the Winter CES.
- Eighteen entertainment cartridges, including *Avenger, Blueprint, Clowns, Jupiter Lander, Kickman, Lazarian, LeMans, Number Nabber/Shape Grabber, Omega Race, Pinball Spectacular, Radar Ratrace, Seawolf, Speed Bingo Math, Starpost, Star Ranger, Supersmash, Tooth Invaders*, and *The Visible Solar System*.
- Two music programs on cartridge, *Music*

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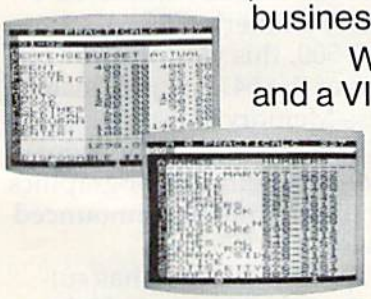

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Machine and *Music Composer*, for the plug-in synthesizer keyboard first shown at the Winter CES.

- Super Expander 64, a cartridge which adds graphics and sound commands.
- Two new programming languages on disk, PILOT and Logo.

Ten new programs were introduced for the VIC-20, including *VICwriter*, a word processor (disk); *SimpliCalc*, a spreadsheet (disk); *VICfile*, a data base manager (disk); *Know Your Personality* (tape); *Know Your Own I.Q.* (tape); *Know Your Child's I.Q.* (tape); *Robert Carrier's Menu Planner* (tape); *Quizmaster*, a quiz-writing tool (tape); *Starpost*, an arcade game (cartridge); and *Number Nabber/Shape Grabber*, an educational game (cartridge).

Commodore also released the third edition of the *Commodore Software Encyclopedia*, an 800-page directory of nearly 2000 programs for all Commodore computers, including independent software. The book sells for $19.95 and is available from Commodore dealers.

Commodore's Executive 64, a portable version of the 64 home computer.

Although Commodore announced no new computers at the Summer CES, there was a little news on the hardware front.

Firing another shot in the ongoing price war with Texas Instruments and Atari, Commodore chopped the wholesale cost of the 64 from $360 to about $200, effective immediately. Since mass retailers can qualify for even lower wholesale prices, this means the 64 will be selling for under $200 *retail* by the time this issue appears. It seems like only yesterday that the 5K VIC-20 was a tremendous bargain at $299.

Some people – including TI and Atari, you can bet – are wondering just how much lower Commodore can drop the price of the 64. Partly it depends on how long TI and Atari can afford to stay in the race. Both companies are suffering huge losses, ironically because they're selling too many computers at prices which are too low. If the price war gets even rougher, it's considered possible that the 64 might bottom out in the $125 range – perhaps even as low as $100. If this point is reached, Commodore probably would have to upgrade the VIC to keep it competitive, maybe by expanding memory to 16K and packaging it with software. Wait and see.

A few products announced at the Winter CES were shown again at the summer show, and release dates generally were pushed back to the fall..These include the Commodore Speech Module, the Digi-Drums, and the plug-in synthesizer keyboard for the 64. Commodore also showed an updated prototype of the portable Commodore 64, first shown at the Winter CES as the SX-100. It's been renamed the Executive 64 and now has a single built-in disk drive (second drive optional), built-in six-inch color monitor, and a tentative retail price of $995. All other features are identical to the Commodore 64. Of course, some of these details could change again before the computer finally hits the market.

One computer that wasn't shown was the P Series announced at last summer's CES. Also known as the P128 or P-500, this was planned to be a souped-up version of the 64. It was to include 128K of Random Access Memory (RAM) expandable to 896K, a much larger keyboard, the more advanced 4.0 BASIC, and the same color graphics and sound features as the 64. Initially announced at $995, it was later lowered to $795.

Unfortunately, it appears the P128 has suffered the same fate as the Max Machine, the low-end game machine/computer also announced last summer. On the verge of delivery, the P128 has been canceled.

There was no official explanation. Unofficially, Commodore sources say the company preferred to concentrate efforts on projects deemed more worthwhile, such as keeping up with demand and strengthening software support for the other computers.

Instead, the P128 has been redesigned as the B128/256-80, a business computer. Gone are the Commodore 64-style color graphics (although the sound chip was retained). It is still planned to have 128K RAM expandable to 960K, 4.0 BASIC, the large keyboard, and the 6509 microprocessor chip (compatible with the VIC's 6502 and 64's

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BUG BLAST - If you think Centipede was fun — look out for BUG BLAST. A new and fast action arcade game with realistic smooth action, quality hi-res graphics and trouble. Its very calm as the first wave attacks. Only a few bugs to kill. Just shoot thru the cactus and wipe them out. After a few attacks you feel you have everything under control. Now the attacks really start. Those protection areas have to go. Blast away. Will they ever stop? OK — the BUGS got me this time. Now its my turn, Just one more time — BUG BLAST — Now its your turn to get even. **$14.95**

BOMB'S AWAY - Can you stop him? The crazy bomber drops the bombs from the top of the screen. You get 3 buckets to catch them. Before you know it bombs are falling so fast you wonder when he will stop. Just when you think you have him under control your bucket gets smaller. Is your hand quicker than your eye? **Special $9.95**

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MOW

MOW - Get ready for the fast and furious action of the craziest mower you have ever seen. How much grass can you cut? Joystick moves your mower around as fast as you dare. Watch out for granny's dafodils and grandpa's radio antenna. **$14.95**

COSMIC CRUZER - Bring the coin-op game into your VIC. 3 Scenarios. Your Cruzer moves over a mountainous landscape & into a tunnel of surface - to - air missle, silos and ground - to - air weapons. If you can make it in and out of the tunnel you fly into the asteroid field. Drop bombs and fire missiles at the fuel dumps to keep your fuel supply up. If you are really good you can get to the base and try, to destroy it. We don't know of any one that has hit the base yet. Maybe you will be the 1st. Cosmic Cruzer is a fun filled magnificently rendered home video game that will last for months of challenge. Highly addicting. Hi-Res Graphics, Color & Sound. **SPECIAL PRICE - $14.95**

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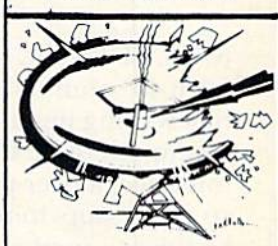
SNAKEOUT - Slip your snake into position and score by chomping the blocks. Watch the way you slither because your escape routes get smaller. 2 Bonus games included. **$14.95**

HEAD-ON - Please do not buy this game if you are the type that says "I'll play it just one more time". Players have been known to start playing HEAD ON at 8:30 p.m. and at 2 a.m., wonder where the time went? Have you ever tried to explain to someone why you played a game for five and a half hours. We know of no remedy for the addiction to HEAD ON except to beat the VIC on level 9. No one has done it, YET, will you? We think not. Move your car as fast as you can dare around the tracks. You get 3 cars and MUST avoid the computer car. Points for the most dots covered. Bonus cars, nine levels of play. **$14.95**

BUG BLAST



TARGET COMMAND

COSMIC CRUZER

SPACE PAK

HEAD ON

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A prototype of the B128/256-80, a business computer that is replacing the canceled P128.

6510). However, screen size has been expanded from 40 columns to 80. Other features planned at this writing include an IEEE-488 slot (as on the Commodore PET computers), an RS-232C serial interface, a user port, and the capability to add co-processors to make it compatible with popular business-oriented operating systems, such as a Z80 chip for CP/M, or an 8088 chip for CP/M-86 and MSDOS (used by the IBM Personal Computer). The B128/256-80 should be available in 1984.

Commodore wasn't the only company showing interesting products for Commodore computers. Independent companies had some new offerings, too.

Maxtron, of Montebello, California, was exhibiting a speech synthesizer for the VIC called the Chatterbox. It's a standard cartridge with a DIN plug that attaches between the computer and the TV. Almost anything typed on the keyboard is pronounced through the TV speaker. It even says "run" when you RUN a program and "ready" when it's done. The retail price was not yet determined, but should be under $75.

Mosaic Electronics, of Oregon City, Oregon, introduced the RAMMASTER 32 for the VIC, a memory expander that brings the computer up to 37K and adds a pause switch, expansion port, write-protect switch, and a disabler switch that allows cartridges to be safely unplugged without turning off the computer. The price is under $150.

Cardco, Inc., of Wichita, Kansas, introduced eight new products for both the VIC and 64. There was the Cardprinter/LQ1, a letter-quality daisy-wheel printer ($599); the Cardprinter/DM1, a 40-column dot matrix printer that uses standard 2¾-inch adding machine paper ($149); the Cardboard/5, a five-slot expansion interface for the 64 ($69.95); Cardkey/1, a 16-key numeric keypad for the VIC and 64 ($39.95); *Printer Utility Programs*, software that allows screen dumps and other tricks with the VIC and 64 ($19.95); *Mail Now*, a mailing list program for the 64 ($39.95); and *Write Now*, a cartridge word processor for both the 64 ($49.95) and VIC ($39.95). *Write Now*, incidentally, appeared to be a very sophisticated word processor at a bargain price. A chaining feature allows book-length files even on an unexpanded VIC.

Unitronics, of Oakland, California, besides introducing a new computer of its own at CES, also exhibited the Waferdrive Module for the VIC and 64. This is a high-speed mass storage device that uses Exatron Stringy Floppy technology (see "Review: Exatron Stringy Floppy For VIC And 64," *COMPUTE!'s Gazette*, July 1983). The Waferdrive Module plugs into the computer's expansion slot and allows you to save and load programs on small endless-loop tape cartridges called "wafers." In some cases a Waferdrive is as fast as a disk drive. Unitronics says the Waferdrive Module will be available this fall for under $100. That price

The Unitronics Waferdrive Module, a low-cost mass storage device for the VIC and 64.

includes two blank wafers and a game, *Miner 2049er*, recorded on a third wafer. In addition, the VIC version includes 8K of memory expansion, plus 2K for the Waferdrive Module's operating system. Unitronics hopes to have 30 to 40 commercial programs available on wafers this fall, too.

Alphacom, Inc., of Campbell, California, introduced two low-cost printers that will work with the VIC and 64. The Alphacom 42 is a 40-column dot matrix printer that has dot-graphics capability for printing finely detailed pictures. It is a thermal printer that uses heat-sensitive paper and a hot-wire print head instead of ink ribbons. The price is $169, including an interface cable for the VIC and 64.

The Alphacom 81 is an 80-column dot matrix printer that also uses thermal paper. It, too, has

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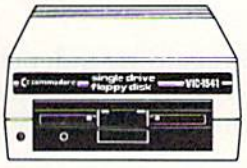

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dot-graphics capability. An interface cable for the VIC and 64 allows the Alphacom 81 to reproduce the full Commodore character set, including graphics – normally possible only with Commodore printers. It will sell for about $200, interface included. Alphacom says both printers should be available by fall.

The biggest news at CES regarding independent software for Commodore computers was Atari's landmark decision to become a "third-party" supplier.

The newly formed Atari Publishing subsidiary will sell hit Atari games for the VIC, 64, TI-99/4A, Apple II, and IBM PC. For those who have been following the home computer price wars, this move might come as a surprise. It would seem to undercut one of Atari's frequently cited selling points for its own computers: namely, that competitors – particularly Commodore – lack a good selection of software, especially popular arcade games. Why would Atari want to boost the software support for competitors by selling versions of its best games?

In a word, profits. Because of the aggressive price-cutting of the past 12 months, no one is making much money selling home computers. This is despite record-breaking sales figures. In fact, Atari and TI are losing money. So far, Commodore is making money, but not as much as it could without the competition. Instead, all the companies believe that the true profits are in follow-up sales – peripherals and software. Especially software.

That explains their strategy of the past year – cut computer prices to the bone to get as many machines into the hands of consumers as possible. The companies hope to create "captive markets," so to speak, for their accessories and software.

Therefore, Atari apparently reasoned, why not convert our most popular games to work on other computers and reap some benefits from our competitors' success?

The result is Atari Publishing. Among its first products will be seven hit arcade games for the VIC and 64: *Pac-Man*, *Centipede*, *Defender*, *Dig Dug*, *Donkey Kong*, *Stargate*, and *Robotron*. All will be sold on cartridges at a suggested retail of $44.95.

Will the other computer manufacturers, including Commodore, follow this line of reasoning and also begin selling software for other computers? This question was put to a Commodore spokesman at a CES press party. Interestingly, he did not rule it out as a future possibility. But for now, Commodore is fully occupied with its push to make enough programs for its own machines, let alone anyone else's. Instead, Commodore seems to be retaliating by cutting its software prices – making "outside" software seem less attractive. However, if this ignites a price war over software as it has over hardware, all the home computer manufacturers will be forced to rethink their strategy. The profits have to come from somewhere.

Besides Atari, other outside suppliers of software for Commodore computers were showing new wares at CES, too. Here are some highlights:

Creative Software, of Sunnyvale, California, was showing four new games. *Moondust* and *Save New York* are for the 64, *Rat Hotel* is for the VIC, and *Pipes* will be available for both computers. All will sell for $39.95.

Pipes won a prize at the show as the best educational program for the home market. Designed for youngsters between 6 and 14, it requires players to maneuver a plumber to install a cost-effective and efficient water network. The trick is to fit together certain lengths of pipe, joints, and valves without ending up with any leaks.

Human Engineered Software (HES), now selling its titles under the name HesWare, announced more than a dozen programs for the VIC and 64. Some are licensed from other companies which sell primarily to the Apple and Atari markets.

For the VIC-20, HesWare has licensed Spinnaker Software's *Kindercomp*, *Story Machine*, and *Facemaker* (educational games very popular among Apple, Atari, and IBM users); Synapse Software's *Necromancer*, *Slime*, and *The Pharaoh's Curse* (graphic adventures); and ISA Software's *Benji* series of educational games.

For the 64, HesWare will sell *Turtle Trainer* and *Turtle Tutor*, introductory programming packages; *Synthesound 64*, a polyphonic music program; and *Maze Master*, a fantasy adventure.

For both computers, HesWare has acquired rights to six popular Japanese arcade games: *Rally X*, *The Pit*, *Chameleon*, *Mr. Jong*, *Mr. TNT*, and *Rootin' Tootin'*. All will be released this fall on cartridges.

HesWare also exhibited a new VIC game, *Laser Zone*, and another program for both computers, *Attack of the Mutant Camels*. The latter is a sequel to HesWare's hit game *Gridrunner* (see "Inside View: Programmer Jeff Minter," *COMPUTE!'s Gazette*, August 1983).

Overall, the Summer CES was good news for software-hungry Commodore users. As more and more Commodores are sold, the market becomes harder and harder for programmers to ignore, so the software outlook should brighten considerably in the next few months. Coupled with Commodore's own trend toward lower prices, VIC and 64 users have something to look forward to.

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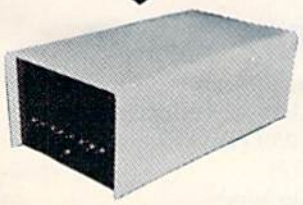

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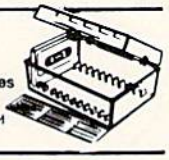

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HOTWARE

A Look At This Month's Best Sellers And The Software Industry

Kathy Yakal, Editorial Assistant

Commodore 64 Entertainment

This Month		Last Month
1	*Jumpman* (Epyx)	–
2	*Zork I* (Infocom)	5
3	*Temple of Apshai* (Epyx)	1
4	*Robbers of the Lost Tomb* (Timeworks)	–
5	*Suspended* (Infocom)	4
6	*Wall Street* (Timeworks)	–
7	*Squish 'Em* (Sirius)	–
8	*Centrapods* (Commdata)	–
9	*Fast Eddie* (Sirius)	–
10	*Zork III* (Infocom)	8

Commodore 64 Home/Business/Utility

This Month		Last Month
1	*Word Pro 3 +* (Professional Software)	3
2	*Money Manager* (Timeworks)	–
	(tie) *Data Manager* (Timeworks)	–
3	*Turtle Graphics* (HesWare)	–
4	*Dome Business* (Computhings)	–
5	*Totl Text* (Totl)	5
6	*HES Writer* (HesWare)	1
7	*Totl Label* (Totl)	6
8	*Easy Script* (Commodore)	–
9	*Calc Result* (Handic)	2

Commodore 64 Educational

This Month		Last Month
1	*Coco* (HesWare)	–
2	*Kinder Comp* (Spinnaker)	–
3	*Facemaker* (Spinnaker)	–
4	*Hey Diddle Diddle* (Spinnaker)	–
5	*Touch Typing Tutor* (Taylormade)	–

VIC-20 Entertainment

This Month		Last Month
1	*Choplifter* (Creative Software)	1
2	*Shamus* (HesWare)	–
3	*Gridrunner* (HesWare)	7
4	*Turmoil* (Sirius)	–
5	*Demon Attack* (Imagic)	–
6	*Sea Wolf* (Commodore)	–
7	*Gorf* (Commodore)	3
8	*Snackman* (Microdigital)	8
9	*Adventure Pack II* (Victory)	–
10	*Rat Hotel* (Creative Software)	–

VIC-20 Home/Business/Utility

This Month		Last Month
1	*Turtle Graphics* (HesWare)	7
2	*Home Office* (Creative Software)	–
3	*HES Writer* (HesWare)	2
4	*Totl Text* (Totl)	5
5	*Household Finance* (Creative Software)	–
6	*VIC Forth* (HesWare)	–
7	*6502 Professional Development System* (HesWare)	–

VIC-20 Educational

This Month		Last Month
1	*Pipes* (Creative Software)	–
2	*Spills and Frills* (Creative Software)	–
3	*Touch Typing Tutor* (Taylormade)	–
4	*Coco 2* (HesWare)	–
5	*Flash 'n Spell* (Qumax)	–

Dry Spell?

What we've heard consistently this month from retailers is that overall sales are slow. "Dismal," as one retailer in Idaho put it. "The longest dry spell we've seen," according to another. Speculation about why this is happening ran from "summer activities" to "the economy" to what is probably the biggest factor: competition from discount stores.

Since we started HOTWARE last month, we have lost two of our sources for the last reason. Many discount stores can sell Commodore 64s, VIC-20s, and software at a lower price than typical computer shops because they can buy their stock in larger quantities at greater discounts. The smaller computer stores usually offer more personalized service and more knowledgeable salespeople, which means greater overhead. Because of the price competition, however, some of these specialized shops are dropping products which they cannot sell.

That's why some retailers who helped usher in the microcomputer revolution by selling those first machines are now discontinuing them. The discounters, though, are contributing in their own way; their aggressive pricing is making computers more attainable by more people. This does tend to throw some business back to the computer stores. Many retailers are emphasizing their differences from the discounters by offering computer classes and by serving as consultants for first-time computer owners.

Still, this "dry spell" certainly does not mean that software sales as a whole are going down – they are just not living up to certain expectations. Long-awaited new software for the Commodore 64 is doing well.

Commodore 64 HOTWARE

The Commodore 64 hotware list seems to change greatly each month. Several factors may contribute to this: the capabilities and newness of the computer itself (which means that programmers are only beginning to explore its potential), the rapidly declining price of the 64 (which means thousands of new owners are entering the software market each month), and the recent flood of Commodore 64 software.

There were lots of changes in the entertainment category. Infocom continues to dominate the list: it holds positions two, five, and ten with its *Zork I*, *Suspended*, and *Zork III*. The Epyx game *Temple of Apshai* fell to third place, but it was replaced by *Jumpman*, another Epyx game. Timeworks made its debut on our HOTWARE list with games in fourth and sixth place: *Robbers of the Lost Tomb*, which sends you on an adventure in search of sacred tablets in ancient Egypt; and *Wall Street*, which makes you a Wall Street investor with a million dollars to spend. Sirius also appears for the first time with *Fast Eddie* and *Squish 'Em*, adventure games that pit you against various critters and "sneakers" as you try to obtain treasure.

Not many changes in the home/business/utility category. Popular programs *Turtle Graphics*, *Totl Text*, and *Totl Label* remain best sellers. They are joined by two new programs from Timeworks, *Money Manager* and *Data Manager*, which tied for second place because many retailers sell them as a package. *Dome Business* by Computhings and *Easy Script* by Commodore appear for the first time in fourth and eighth place.

In educational software, second, third, and fourth place were taken by Spinnaker with *Kinder Comp*, *Facemaker*, and *Hey Diddle Diddle*. HesWare (formerly HES) claimed first place with *Coco* (watch for *Coco 2* to appear here soon), and Taylormade's *Touch Typing Tutor* again appears on the list this month in fifth place.

VIC-20 HOTWARE

VIC-20 software sales seem a bit more stable than those of the Commodore 64, though there are a number of new entries in the entertainment category this month.

Creative Software and HesWare dominate the list in all three categories. Creative Software takes first and tenth place in entertainment with *Choplifter* and *Rat Hotel*; second and fifth in business with *Home Office* and *Household Finance*; and first and second in education with *Pipes* and *Spills and Frills*. All of these Creative Software programs, with the exception of *Choplifter*, are new to the list this month.

HesWare's *Gridrunner* moved up a few notches to be the third best-selling game. *Shamus*, licensed from Synapse by HesWare, is a scrolling maze adventure originally written for the Atari that landed in second place in its first month on the list. *Turtle Graphics*, *HES Writer*, *VIC Forth*, and the *6502 Professional Development System* (a cassette-based 6502 assembler package) are HesWare's best-selling business programs this month, while *Coco 2* made its debut in the No. 4 slot in educational programs.

Imagic's *Demon Attack* premières in fifth position in the entertainment category, followed by two from Commodore: *Sea Wolf* and *Gorf*. *Adventure Pack II* from Victory Software appears in ninth place in its first month on the list.

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Demon Star

FOR VIC AND 64

Stan McDaniel

Janice Fary

Packing arcade-style quality into the unexpanded 5K VIC-20 is a tough BASIC programming challenge, but I think you'll find that "Demon Star" comes through with flying colors (plus sound and custom graphics). Your universe is being invaded by Demon Stars, which appear at unpredictable intervals and can destroy all life forms in their vicinity. A defense shield protects your home area, but vast amounts of energy are needed to maintain it.

Your mission: to penetrate lifeless areas already devastated by Demon Stars and to transmit energy units back to your home planet.

Your starship moves horizontally, vertically, and diagonally, controlled by a joystick. The joystick fire button shoots matter conversion torpedoes. When you are not busy defending yourself from Demon Stars or chasing dangerous Quasars, you convert celestial objects into valuable energy units by scoring direct hits with your torpedoes. Nebulae net you five energy units, single-spiral galaxies ten units, stars 15, and double-spiral galaxies 20.

Blasting Quasars

Quasars appear frequently, accompanied by a deep-pitched warning sound. If you do not destroy a Quasar before it disappears, you lose 500 energy units. An energy drop below zero destroys your ship, as does a collision with any celestial object. Demon Stars show up less frequently than Quasars, but they are far more dangerous. Their negative energy field restricts the range of your torpedoes, and failing to hit a Demon Star within the allotted time costs you your ship.

When you shoot down a Quasar, you receive 100 energy units. A Demon Star gains you a whopping 500 units. In addition, you receive a 100-unit bonus every time you manage to collect 1000 units on your own. But watch out! When your energy store exceeds 3000, your ship will begin moving to a more densely populated area of the universe, and Demon Stars will appear with greater frequency. To help you keep track, your total accumulated energy units are displayed continuously. A timer also appears whenever a Quasar or Demon Star enters your area.

Preparing Demon Star — VIC Version

The VIC-20 version of Demon Star consists of two programs: the main program, and a second program which records a special data file on the cassette tape following the main program. Turn on your VIC, type NEW, and then type in the main program (Program 1). It is fairly long and very compact, so you must type with care. If possible, have a friend read back the program from the screen after you have typed it, while you check the printed version. Many errors can be caught this way.

After the main program has been typed and proofread, copy it to cassette with a SAVE "DEMON STAR" command, then rewind the tape and issue a VERIFY "DEMON STAR" command. When the verification is complete, press the STOP button on the recorder. Now clear memory with NEW and type in the "DATA" program (Program 2). When this is completed accurately, type RUN. You will be prompted to press PLAY and RECORD on the recorder. When

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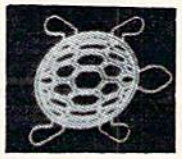

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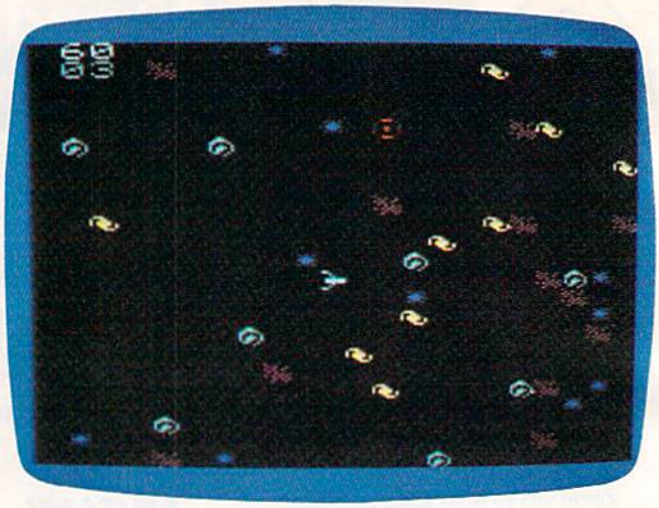
In "Demon Star," the spaceship (center) must avoid crashing into celestial objects while hunting explosive Quasars. (VIC-20 version.)



"Demon Star" for the Commodore 64.

you do this, a data file entitled "DF" will be copied to your tape immediately following "DEMON STAR." Finally, SAVE the data program under the name "DATA" on another tape, just in case you need it again. A spare copy of the main program also is a good idea.

To play the game, plug a joystick into the VIC game port. Insert the Demon Star tape into the cassette player, rewind it, and issue a LOAD command. You will be prompted to press PLAY on the recorder. When the program completes loading, leave the PLAY button down and enter a RUN command. The screen color will change and a WAIT message will appear.

Wait patiently while the program loads the data from the data file. You will see the tape stop and start several times. Do not interfere with this process. The loading is complete when a screen prompt, "LEVEL?," asks you for your choice of skill levels (there are ten levels of play). Press STOP on the recorder, type a number (the skill level you want) between 1 and 10, and press RETURN.

I prefer to start at level four, but a first-time player might want to pick level two or three. As soon as the level is entered, the screen color will shift to deep blue, and after a few moments the Demon Star universe will scroll majestically into view. Your starship will be resting at the bottom left of the screen. After a brief pause (giving you time to look things over), the ship will take off, bent upon its energy-gathering mission.

Demon Star Strategy

If there are any celestial objects immediately in front of the ship which might interfere with your takeoff, press the fire button immediately and hold it down. The obstructing objects will be destroyed as your ship gets under way. Yellow double-spiral galaxies are worth the most, so head for them (controlling direction with the joystick) and start firing. Your normal firing range is about one-third of the screen width. When a Demon Star is on the screen, the range drops to slightly less than one-fourth of the screen width.

When a Quasar appears, you must find your way to it and fire your torpedo within the time limit, making some split-second decisions about the shortest path through the maze of objects. You will have time to blast one or two objects out of your way, if necessary. An unvanquished Quasar drains 500 energy units, so you will want to accumulate more than 500 units as soon as you can to keep from blowing up (which happens, remember, anytime your energy drops below zero). The best way to insure survival is to destroy five Quasars right away.

When you reach higher levels of play, blast strategically placed objects out of your way quickly, carving out paths which give your ship easier access to all areas of the screen. Your ship and your torpedoes can move across the screen border and come back on the other side; do not forget this when you are in a tight spot!

The entry of a Demon Star is heralded by a blinding flash, followed by the roaring of pure negative energy. Keep calm enough during this nerve-rattling display to find the Demon Star, get into firing position, and destroy it before your time runs out. Demon Stars are the same color as regular stars, so even though they have a different shape, you have to be sharp-eyed to spot them in time.

The skill levels automatically advance as you score more points. A beginning player starting at skill level four will find it difficult, but not impossible, to reach a score of 1000. If you manage to accumulate more than 6000 energy units, you will be playing at level eight. An expert will reach 10,000 units at this level. Master players will be

able to play at skill levels nine and ten. The game will not advance automatically to these highest levels, so the player must select them when the game starts.

If your ship is destroyed, your total score will be displayed, and you will be asked if you want to play another round. Typing Y will start a new round, and typing N will exit the program. If you exit the program by accident and you want to play again, type RUN 7, not just RUN.

Customizing The VIC Program

For those who would like to change some of the characteristics of play, the following information will prove helpful. To make changes in the program, follow the editing procedures in the first two chapters of *Personal Computing on the VIC-20* (the manual that came with your computer).

Lines 12-16 lower the screen out of visible range, print the game universe on the screen, and scroll the screen up again. The expression (3*SK) in line 13 determines the number of celestial objects which will appear on the screen for any selected skill level (SK). If you want to make the game easier you can change this to (2*SK). Note the FOR/NEXT loop at the end of line 16; it is important, because the delay it creates gives the player time to look over the situation before the action begins. To create a longer delay, make the loop maximum greater than 1000.

The main program loop is in lines 17-33. The IF statement at the end of line 17 sends the program (at random intervals) to the Quasar/Demon Star routine at lines 63-66. If you want the Quasars and Demon Stars to appear with greater frequency, decrease the argument of the function FNR. For example, change FNR(10) to FNR(8). Increasing the value will decrease the frequency.

If a player runs out of time when a Quasar or Demon Star is on the screen, the IF statement at the end of line 18 sends the program to a "time out" routine at lines 72-74. As the program stands, a player has about 12 seconds before running out of time. To increase the amount of time, increase the figure 700 in line 18.

As you know, the torpedo firing range is inhibited by the appearance of a Demon Star. This is accomplished in line 63 by the expression RG=5, lowering the range (RG) to five screen locations or about one-fourth of the screen width. Changing the value of RG at this point will change the Demon Star's effect upon the range.

The normal range of the torpedo is set by RG=8 in line 8. The current value of eight screen locations seems just right. The longer you make the range, the easier the game will be. If you decide to try out a different range, you must change the value of RG not only in line 8, but also in line 46 (this is where the range is reset to normal after a Demon Star has been destroyed).

Scoring for objects hit is accomplished by lines 46-48. The formula PT=PT+((L-41*5) in line 47 sets the point scores 5, 10, 15, and 20 for each of the four types of objects. Changing the "5" to "6" here would change the scores to 6, 12, 18, and 24. Line 48 sets the value of a Quasar, and line 46 establishes the 500-point value of the Demon Star. The bonus points are controlled by lines 67-69.

Another scoring control appears in line 73, where PT=PT-500 decreases the score when a Quasar "times out." To vary the amount of decrease, change the figure 500 in this line.

If you have any questions or comments regarding Demon Star, please feel free to write me at the address given below. I will be happy to provide you with a verified cassette copy (for VIC only) of the game and the data program upon receipt of a cassette, a self-addressed, stamped cassette mailer, and $3.

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See program listings on page 113.

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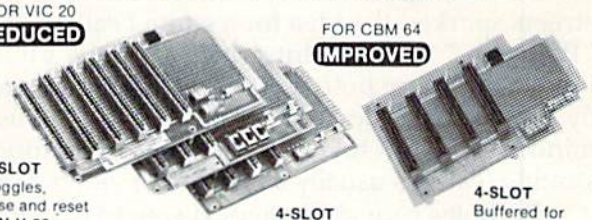

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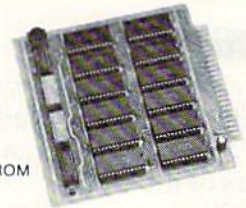

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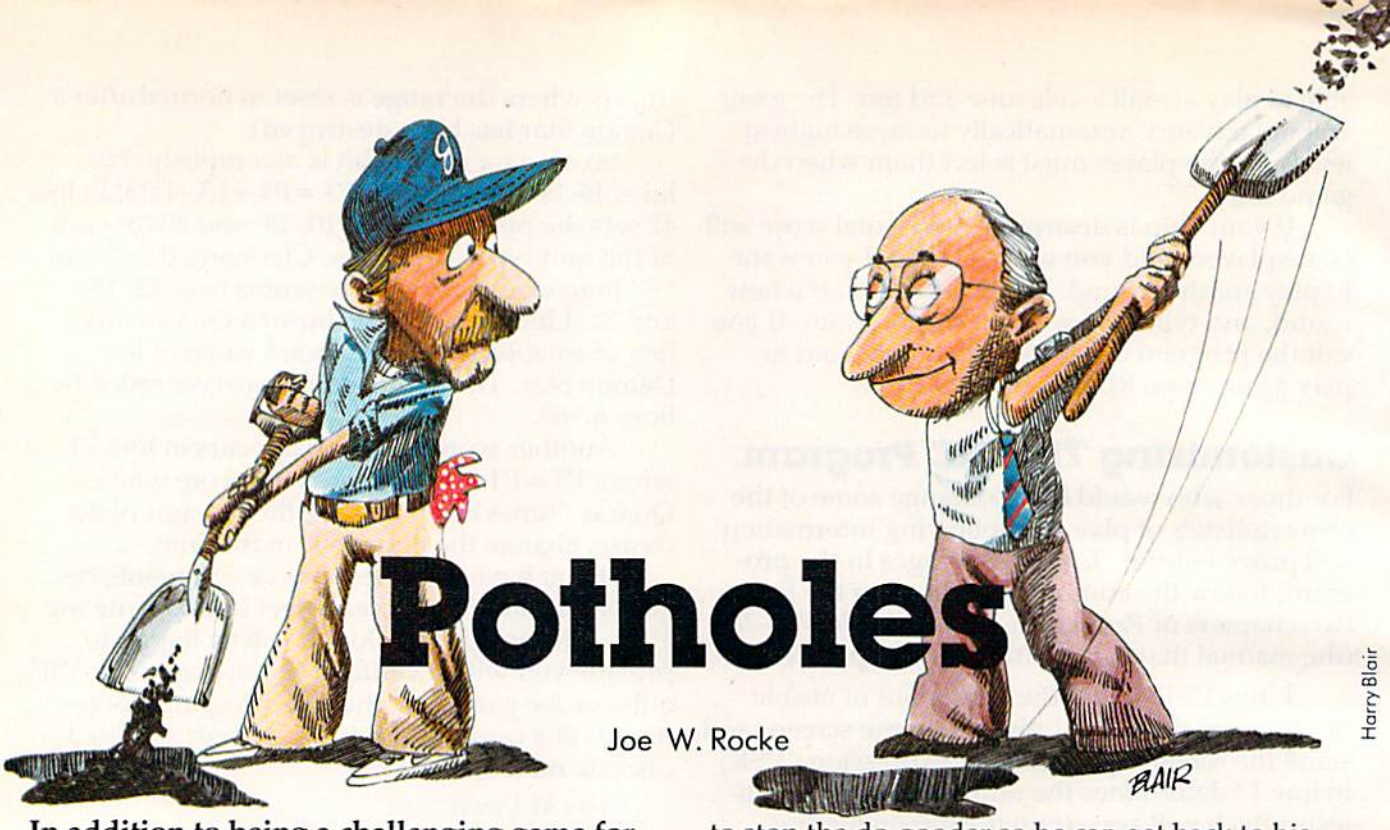

Harry Blair

Potholes

Joe W. Rocke

In addition to being a challenging game for the VIC and Commodore 64, "Potholes" demonstrates how user-generated graphics can produce an arcade-quality display in an unexpanded VIC.

A chance remark about the condition of our local streets sparked the idea for a game I call "Potholes." After my introduction to the VIC-20, I felt it had more potential than that demonstrated by programs in the owner's manual. With this in mind, I set about to develop a program demonstrating features usually displayed in video games.

Potholes provided an ideal way to explore how to combine a unique playing field, custom graphics characters, a multicolor display, sound, and fast movement in a single program. In addition, the ultimate challenge was to squeeze the program into an unexpanded VIC-20 without losing the custom graphics.

A Good Citizen

A symmetrical city map provides the basic layout for the game. The streets are filled with potholes. Two cars, each a different color, are parked at opposite corners of the city. You, the player, a public-spirited citizen, are determined to fill the potholes by driving through the streets. For each pothole you fill, you gain five points. The score is displayed and constantly updated as you obliterate the potholes.

Meanwhile, the street commissioner (the computer) is determined to replace the potholes so he can keep his street crew busy. He also wants to stop the do-gooder so he can get back to his desk. As he dashes through the streets trying to intercept you, his car leaves a trail of potholes.

Your car moves under keyboard guidance. The commissioner's car automatically takes a preset course at first, but as play continues, the commissioner becomes smarter and assumes an intercept course. A collision between the two cars terminates the play. The score is moved to the HIGH SCORE block, and the SCORE block is reset to zero. The playing field is reset, and the cars are returned to their respective corners for the next play.

The multicolor display and the cars are the more unusual aspects of the game. The cars not only change direction, but also maintain proper orientation to the direction of movement. The custom characters which make up the playing field and cars demonstrate the high-resolution display capabilities of the VIC-20.

Overcoming The Problems

Moving a custom character (such as the car) about a playing field poses three primary problems: position control, character protection, and low memory overhead. Memory overhead was a major concern in developing a program of this type. To meet this requirement, a two-part program approach was used.

The initialization (Program 1) is literally the heart of the game. It contains the data for the custom characters and loads it into a block of protected memory. This prevents the data from being destroyed when the main program is loaded. After the initialization program is run, it automatically self-destructs to free memory space occupied by

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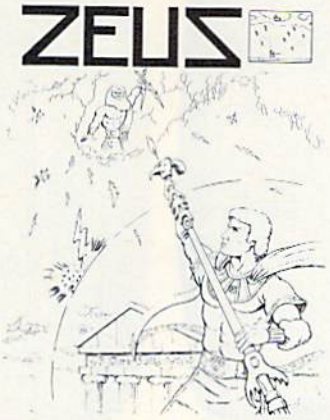

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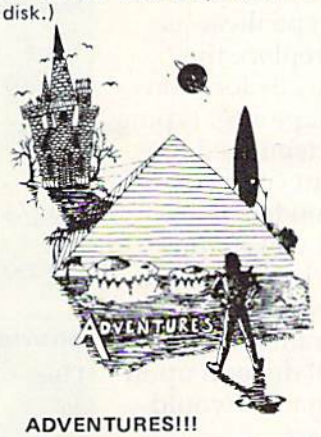

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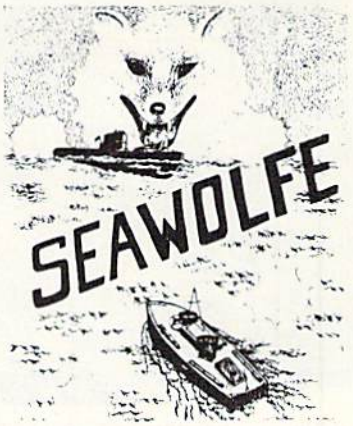

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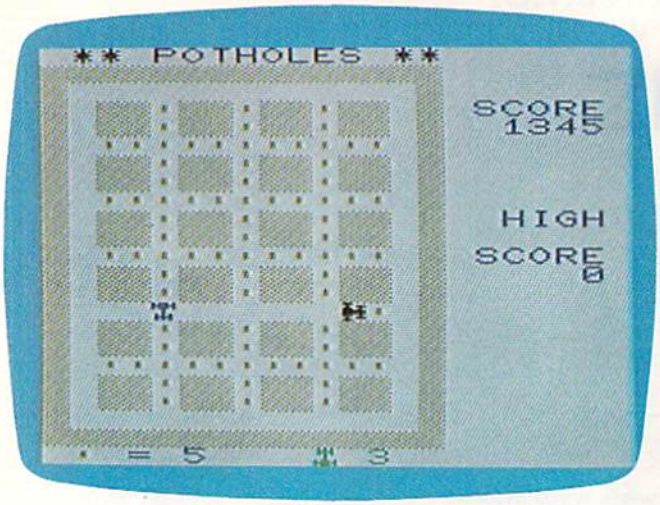
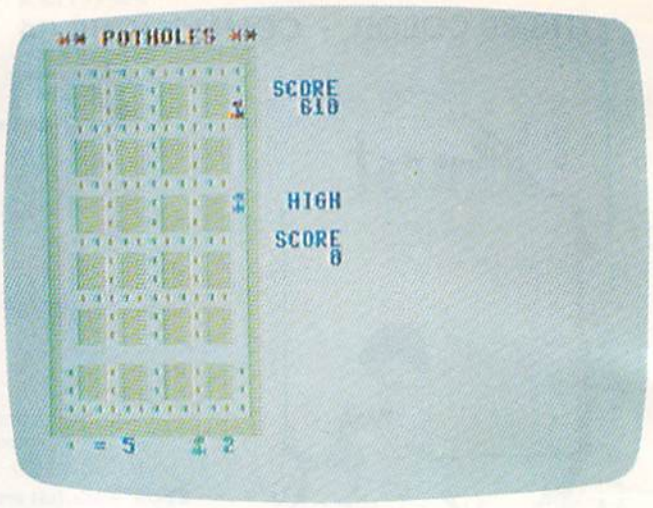


In "Potholes," you must navigate deteriorating city streets in your car while fleeing from the pursuing Street Commissioner. (VIC-20 version.)



"Potholes" for the Commodore 64.

the program lines.

The main program (Program 2) contains all the elements necessary to display the playing field, control characters, produce sound, and maintain the score. Note the unusual characters in the program listing. Be sure to type these as shown, for the custom characters replace the characters normally stored in these key locations.

Be sure to SAVE the listing to tape after typing it in. Once you have the program debugged to eliminate typing errors, try different color codes for the background and maze. If you like to experiment, try including a loop that will change the color of the game field after each play. There are about 500 plus bytes of memory left for experimentation after the main program is loaded. The color quality of the display will depend upon your TV monitor. The ideal combination would be colors that provide a high contrast.

The Custom Characters

Since all VIC characters are stored in ROM, this information cannot be changed by the user. But the ROM character pointer is stored in RAM, and it can be changed to point elsewhere in RAM. The pointer is at decimal 36869, 36870. The normal PEEK value of 36869 is 240, which enables the cursor and uppercase character/graphic set. (A value of 242 enables the alternate lower/uppercase set.) POKEing 36869,255 moves the pointer from the normal 32768 address to 7168, which is the top of BASIC RAM. Since the range of BASIC RAM is normally from 4096 to 7679, moving the pointer to 7168 protects 512 bytes, enough room for 64 characters, from BASIC.

Because custom characters require redefining existing keys, the selection was based on keys not required for programming. In this case, the right and left math brackets ([ ]), the up (↑) and left(←) arrows (not cursor arrows), and the exclamation mark (!) were reserved for character definition.

In addition, the RAM area used to store the custom characters must be protected so it will not be disturbed by the main BASIC program. This

Structure Of Initialization Program

Lines	
190-200	Reset memory pointers to permit loading character data.
210-220	Block move to move desired graphic and text characters from ROM to RAM.
230	System call to initiate the move.
240-250	Load data for custom designed characters.
260	Set memory pointers to protect data.
270-290	User prompt and delete program.

Structure Of Potholes For The VIC

Lines	
50	Reset pointer to point to custom character set in RAM.
890-1070	Set up the playing field.
70-120	Key scan routine to check for driver input that moves red car.
180-210	Computation of playing-field coordinates.
310	Pick up potholes, increment score, sound on/off.
320-330	Sound routine.
600-700	Sound routine.
740-860	Game end prompts.
870-880	Recycle game for next play.

Variables Listing

A,B	Screen print location
BO	Bonus points per game
CA	Sets number of plays per game (line 1090)
CN	Sets field color background (line 580)
CR	Color screen – experiment with different values
D	Sound effects on/off
HS	High score
HX,HY	Playing-field coordinates
S	Current score
SL	Sound loop
SU	Sound routine
TE	Total accumulator for score
VR	Screen print location

is accomplished by adjusting the top-of-BASIC pointer (51-52) and top-of-string pointer (55-56). (In the 6502 chip, the low byte is stored first, followed by the high byte.) Both pointers normally point to 7680 and must be changed to point to 7168. This change is made when the initialization program is run.

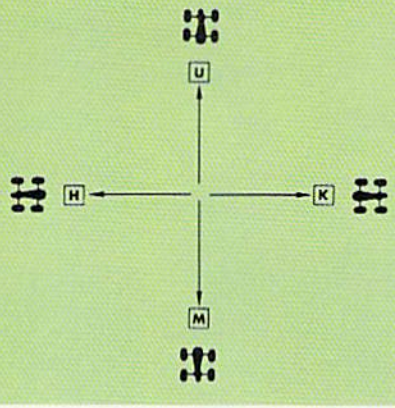
To examine the custom characters individually, load and run both the initialization and the main program. With the main program running, press RUN/STOP (do not press RESTORE). Now try pressing the keys that have been redefined for custom characters.

Repairing The Roads

The M, K, H, and U keys are used to maneuver your car. (See the figure.) As you obliterate a pothole, the act is accompanied by a blopping sound, and your score is increased by five points. Meanwhile, the commissioner (blue car) is on his way to wipe you out. If he travels a street you have cleaned up, he leaves a new (yellow) pothole in his wake.

At the game's end, a prompt gives the player a choice of repeating or exiting the game. A "yes" response restarts the game, retaining the high score. If you wish to reset the HIGH SCORE display, press SHIFT and CLEAR/HOME. A "no" response restores the ROM character pointer and returns the VIC to "Ready" status.

Keyboard Control Diagram



64 Notes

In the 64 version of Potholes, there is no sound routine. Because of the abundant memory available in the 64, Program 3 is self-contained. There is no need to load and run the initialization program.

See program listings on page 115.

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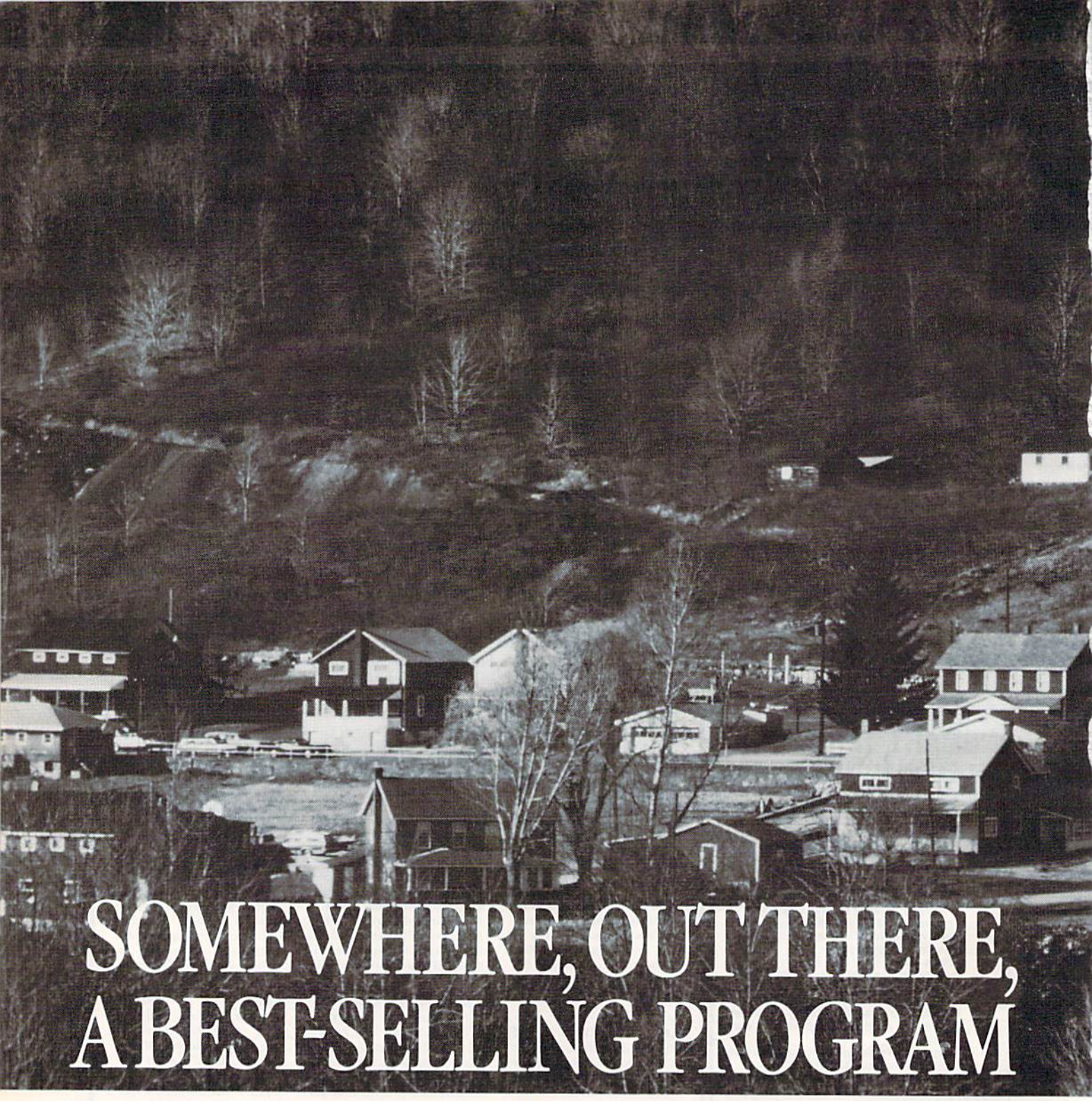

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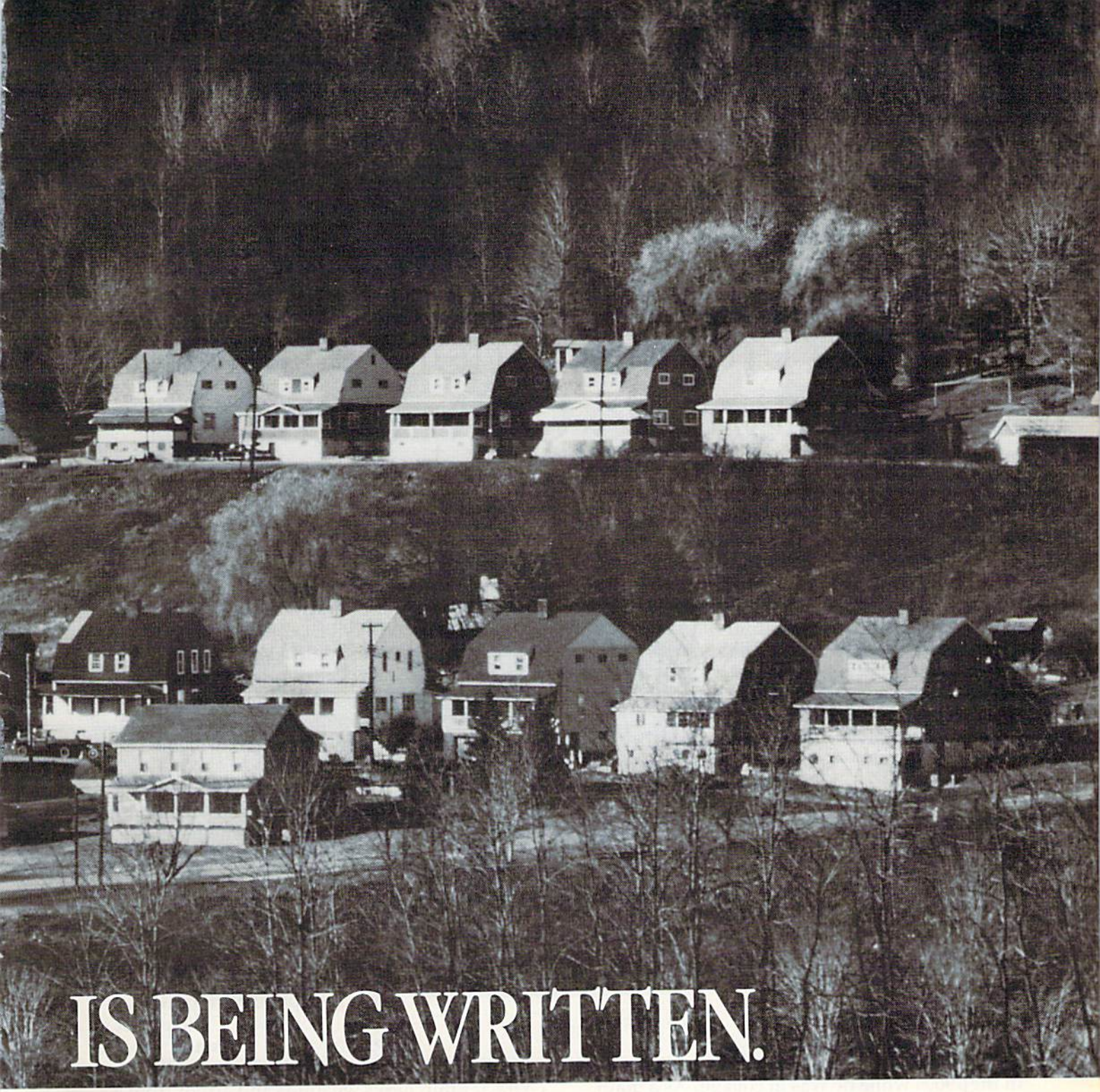

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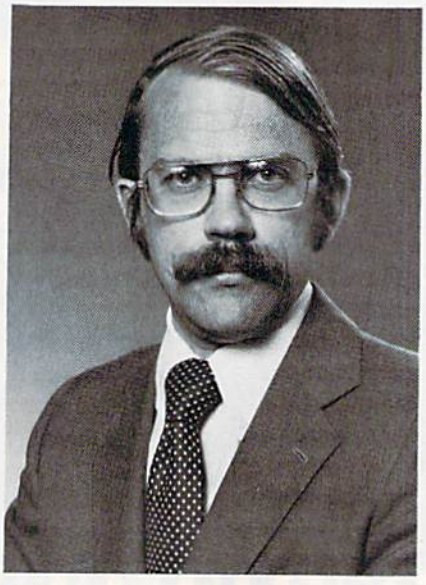
Jim Connelley

The Programmer Behind *Temple Of Apshai*

Kathy Yakal, Editorial Assistant

In the few months it has been on the market for the Commodore 64, *Temple of Apshai* has enjoyed tremendous success. Here's a look at the man who created it, Jim Connelley, chairman of Epyx Software.



Jim Connelley

Many of today's successful game programmers were still in junior high school when the first microcomputers came out. But Jim Connelley, the programmer behind *Temple of Apshai*, has watched the evolution of these machines for 20 years.

Connelley became interested in programming in the 1960s while he was in college. As a math and physics major, he realized that computers were important in advanced problem-solving. But what really intrigued him about computers and enticed him into programming was "the need to make an inanimate object do what you want it to do," he says. "It's fun to do that. I think most programmers would agree." Connelley went on to work as a programmer in a division of Westinghouse which built nuclear reactors.

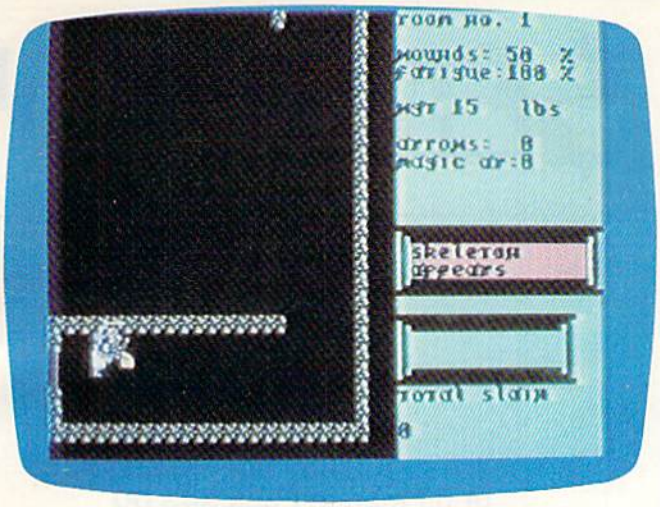
So why did he start writing games? "I've always been interested in games as games, even before microcomputers came into being," says Connelley. He bought a Commodore PET computer in 1978 and started developing game ideas. His first efforts became *Star Fleet Orion* and *Invasion Orion*. About the same time, Connelley formed Epyx Software, of which he is still chairman.

Connelley prefers writing games to his earlier programming jobs. "There's something very nice about creating a good game that people can enjoy," he says. "Other types of programming are not as satisfying."

Temple of Apshai, the Epyx game that is so popular right now, is a "dungeon quest." The player is given (or is allowed to create) a warrior with strengths and weaknesses. This character purchases weapons and armor from a bartering innkeeper, then sets off for the dungeon's many rooms to find treasures and defend himself against antmen, giant mosquitoes, and other creatures.

Temple of Apshai came about for two reasons. First, Connelley recognized the popularity of noncomputer role-playing games, such as *Dungeons and Dragons*. Second, he believed it would be possible to create a graphics-oriented adventure game on the Radio Shack TRS-80 computer. So he did it.

But, Connelley acknowledges, he didn't do it



"Temple of Apshai," Commodore 64 version.

alone. "I find a team approach helpful in programming." Though he was the main programmer on the original version of *Temple of Apshai*, several other people were involved in the development. One of them, Steve Bryson, translated the game for the Commodore 64.

Versions for other personal computers have evolved, depending on each machine's capabilities. Naturally, each new version adds even more features to the basic concept.

Sequels to *Temple of Apshai* have been created. The first, *Upper Reaches of Apshai*, is a tongue-in-cheek adventure that takes place in the innkeeper's backyard. *Curse of Ra*, the third in the series, is set in ancient Egypt and is more difficult than the first two. The sequels are not stand-alone programs, but essentially data files; *Temple of Apshai* must be loaded before they can be run.

Connelley cites several reasons for the success of the dungeon quests. "We took a lot of care and effort to make something that played well," he says. "We spent two months in intensive playtesting, getting algorithms (programming patterns) that would make a good game...and the basic subject is interesting to lots of people. People like role-playing fantasies."

Another reason may be that some people are tiring of so-called "shoot-em-up" games. Strategy games are generally much more complex than games based on fast reactions. Strategy games use huge data files, which require more time for loading, but which in return provide players with hundreds of different screen images and challenges. Connelley believes the market will continue to move towards such games.

To do well in *Temple of Apshai*, for example, Connelley says it's important to pay attention to the strengths of your character. If your character has a lot of ego and gets wounded, he would probably continue to fight just to prove that he can: subtle things like that.

Connelley warns aspiring game writers that programming involves "fewer tricks than hard work. An important part is thinking clearly and logically about the process. You have to have a clear idea of what you want the game to do, and how people are going to interact with it and enjoy it."

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FRED D'IGNAZIO,
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A Robot Inside Your Computer

I've just returned from London, England, where I taught a three-week course on robots.

Our classroom looked like a scene from *Dr. Who*. Every student in the room had a computer and a robot. The robots were not humanlike androids like C3PO and R2-D2. They were miniature robot arms mounted on metal boxes that looked like batteries or electric pencil sharpeners.

The arms came in all the colors of the rainbow – red, orange, blue, and green. They ended in pincerlike claws, or grippers. Each arm was wired to a student's computer. The student programmed the computer to control the arm. When the arms moved, they buzzed. The classroom sounded like a beehive with a thousand buzzing bees.

Arms moved in all directions. Some picked up erasers, others grabbed small metal blocks and cylinders. Two arms worked together, and even managed to shake hands – or claws! Another arm began moving too fast. It spun around in a circle, got dizzy, and fell off the table.

Turtles, Boxes, And Dinosaurs

The miniature, tabletop arms weren't the only robots in the room. A giant arm was over in the corner of the room near the window. When it wove and swooped, it looked like the neck and head of a prehistoric brontosaurus. A Tasmanian turtle robot scooted around on the floor, drawing pictures and saying "Hello!" A metal-gray, two-foot-high robot (that looked like R2-D2's kid brother) wandered around the room laughing, saying "HA! HA! HA!" and spinning its head in a circle. And a robot that looked like a little red box zipped back and forth across the kitchen floor carefully staying on its robot "sidewalk." The sidewalk was a piece of black tape that wound around the floor like a piece of licorice candy.

Computers In Their Tummies

This classroom was a real place. It was in a small, red-brick building on the edge of London, in southeast England. I was one of the teachers at a course on "Robotics Literacy." Students from all over the world were getting a chance to play with real robots and learn how to program them using computers.

One robot's computer was a small, green circuit board mounted inside the robot's tummy. The other robots' computers sat on top of tables. The tabletop computers included an Apple IIe and two British computers – a BBC and a Jupiter computer.

The computers' electrical signals controlled the robots. The signals flashed along wire "leashes" plugged into the robots' heads and bottoms. The signals were generated by programs stored in the computers' memories. The students wrote the programs in Robot Language, ARM-BASIC, BASIC, and Logo. The programs made the robots talk, walk, roll around, draw cartoons, play games, and make buildings and bridges out of blocks.

Robots For Kids

Our classroom was real, but it really did seem to be more like science fiction than real life. I know of no other classroom in the world where students got to play with so many computers and so many robots.

Few classrooms have their own robots. The same is true for kids at home. Not every kid has his or her own robot. In fact, very few do. Robots, even in kit form, cost hundreds, or thousands, of dollars.

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Lots of kids are building robots from kits, but this takes a lot of patience and a lot of careful, painstaking work. (If you would like to learn more about building a robot of your own, take a look at my book *Working Robots*, Dutton/Elsevier-Nelson, 1981.)

Even the new "home robots" are pretty expensive and may cost several hundred dollars. But soon, maybe only in a couple of years, kids are going to have a lot more robots.

While I was in England, I went to a Robot Convention. There were a thousand robots at the convention, in all shapes and sizes. Most of the robots were big and expensive and designed for work in factories. But a surprising number were small, friendly, and cheap. They were the first generation of *kids' robots*. Like the more expensive robots in our classroom, they came in four styles – arms, boxlike buggies, turtles, and baby R2-D2s. Judging from what I saw at the convention, I'd predict that these kid robots will soon cost the same as a personal computer (less than $100) and come in all shapes, sizes, and colors.

The new low-cost kids' robots will be easy to program (in BASIC, Logo, PILOT, or Pascal). You would train your robot by programming it. You could train your robot like you would train the family dog or cat.

The robots will be able to talk and maybe even listen. They might not be able to understand spoken commands, but you might be able to give them orders by clapping your hands a certain number of times (for example, one clap to make them go forward, and two claps to make them go backward).

Or you might control them by whistling or making funny noises. When you shouted "Boom!," the robot would wave its arm; or when you sang "La! La! La!," it would roll around in a circle.

Kids' robots will also have *sensors* – electrical devices that imitate human senses like seeing, hearing, and touching. Your robot will probably have several "eyes," in the form of sensors that detect motion and measure distance.

Robots that can see can become quite independent little creatures. You will be able to turn a seeing robot loose in a room, and it will find its way around chairs, tables, and people's knees. However, if an object is too low or too high, the robot might miss it. Then, watch out! Your robot may trample your dog's tail, run over your toes, or get lost underneath the dining room table.

Robots will also have sensors that detect light, sound, and heat. Some, like the robot turtles and buggies, will even have a sense of touch. Tiny sensors called *microswitches* can be mounted around the base of the robot. When the robot bumps into something, the switches are pressed down and close an electrical circuit. This sends a message to the robot's computer. Using a control program (that you have to write), the robot will "know" it has bumped into something. Depending on the program, the robot may back up and try to go in a different direction, or it may try to bully its way forward, like a tank or bulldozer.

Many robots today have to be plugged into an electrical outlet on the wall or into a tabletop computer. In the future, all robots will get their orders invisibly, through the air, via microwaves or radio signals. And they will have their power source mounted inside their body, as a rechargeable battery. This will make the robots much more independent. You will turn the robot loose and forget about it. You might not even remember that a robot is in the room, until it marches up behind you, crashes into the back of your leg and says, "BOO!"

Microbots

These neat little robots will be here in just a year or two. But you don't have to wait for them. If you have a computer handy, you can create a robot now – as a program inside the computer.

You may be thinking: how can a robot live inside my computer? But think of the video games you play, on your computer and at the local games arcade. The games are really computer programs. The programs use sound effects and colorful graphics to create the illusion that tiny creatures live inside the machine. You can see these creatures by looking through the picture-screen "window" on your TV or on the big screen in an arcade game. The creatures can be any shape the game designer imagines – aliens from outer space, snorkle-nosed potato heads, vampires, football players, *or robots*.

In the coming months, we'll create programs you can run on your VIC or Commodore 64. We'll start with simple programs that just create the robot's shape. You will be able to "build" fat robots, skinny robots, funny robots, and scary robots.

Next I'll show you how to bring the robots to life. You will animate them the way moviemakers animate cartoon characters.

After that you will create *robot worlds*, places where the robots live. The first world might be a small model of your bedroom or living room. Or it could be a simple place with boxes and circles, where your robot first learns how to walk. Later on, you will build more complicated worlds.

Turning your robot loose in a complicated world with lots of objects and lots of things going on is like opening the front door and letting a real robot go outside to play. If you live in a big city or on a busy street, this could be a pretty risky thing to do. Your robot needs to learn a lot before it's

ready to cope with the outside world.

At first you'll control your robots as if they were puppets. When you push the up-arrow, they'll move up; when you push the down-arrow, they'll move down.

Later on, you'll turn your robots loose in their picture-screen room and let them wander about. At first, you can make it easy on them by letting them explore an empty room. (That way, they can't get into too much trouble.)

Last, you'll create obstacles in the room – tables, chairs, pets, maybe even holes, pits, doorways, and mazes. This will be a great way to test your robots and see how smart you've made them. It will also be a great way to think up ways to make the robots even smarter.

Best of all, by working with *microbots* (robot programs inside your computer), you will be getting prepared for programming real robots. Before you know it, these real robots will be here. They'll march through the front door into your home and become your pet, your servant, or your friend. (Or maybe all three!) But the key to all their skills will be the programs that run inside their computer brains. The robots will come with a few programs already written. But if they are to learn any new tricks, you'll have to teach them.

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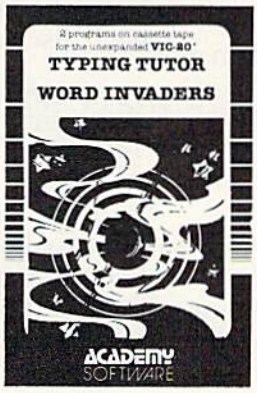

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DAN CARMICHAEL, ASSISTANT EDITOR

Understanding Random Numbers

In this month's column we'll learn about BASIC's random number generator, the RND command, and then use it in a simple dice-roll program that you can expand. The information in this column applies to both the VIC-20 and the Commodore 64.

Webster's Third New International Dictionary defines *random* as: "marked by absence of bias: having the same probability of occurring as every other member of a set."

The RND (random) command is a function of the BASIC language in the VIC and 64 (as well as in other computers) that does just that. In other words, under your control it will generate any number in a range between zero and almost any number you choose.

This can be a very useful tool in a variety of programming applications. For instance, you might want to generate two *INTegers* (whole numbers) each between 1 and 6, to simulate the random throw of two dice. Or you might want to produce a random number between 1 and 52 to simulate the drawing of one card from a deck of cards. The possibilities are limitless.

How The RND Command Works

The RND command, in its primary form, creates a number from 0.0 to 1.0. Enter the following short program to see how this works.

```
10 X=RND(0)
20 PRINTX
30 GOTO10
```

In this example, the computer produces many numbers, at random, between 0 and 1. Hold down the CTRL key to slow the speed of the screen PRINTing while running the program. As you can see, there is no definite pattern to the numbers being produced. We'll talk more about this later.

Producing Random Numbers Within Ranges

The ability to make the computer produce a specific range of numbers (between 1 and 6, or 1 and 52, for example) is controlled by the programmer, who adds a few things to the RND statement. Enter the following short program, run it, and we'll discuss what the RND statement is doing.

```
10 X=INT(RND(1)*6)+1
20 PRINTX;
30 GOTO10
```

In this example, we told the computer to produce integer (whole) random numbers from 1 to 6. To accomplish this, we've added more functions to the RND statement. Let's break down and analyze the additions.

X is simply the variable that will receive the random number. Every time the computer produces a random number, its value will be transferred to X.

INT is a BASIC command that turns numbers with fractions into whole numbers. In positive numbers it does this by dropping the fraction without rounding off. For example, the INTeger value of both 1.00001 and 1.99999 would be 1. To test this, type in PRINT INT(1.00001) and then press RETURN. Now type in PRINT INT(1.99999) and press RETURN. In each case, the value is 1.

The format for the INTeger command is: INT(X), where X is the number you want to convert into a whole number.

(RND(1)*A) = B is the main body of our random number generator. **RND** is, of course, the

BASIC command that we have been discussing. It produces the random number we want to suit our programming needs.

A represents the range of numbers you want the computer to produce. In our example, we used 6. This produced a range of six numbers, or 1 through 6. If we had used 52, it would have produced a range of 52 numbers, 1 through 52.

B defines the lowest number in the range of numbers we want to produce. We told the computer that the lowest number we wanted was 1. If we had replaced B with a 10, the computer would have produced a range of six numbers, the lowest being 10. The possible results would have been 10, 11, 12, 13, 14, and 15.

Here are a few working examples that may help you understand this concept:

X=INT(RND(1)*100)+1 would produce a possible 100 random numbers starting at 1, or 1 through 100.

X=INT(RND(1)*100)=100 would produce a possible 100 random numbers starting at 100, or 100 through 199.

X=INT(RND(1)*2)+5 would produce a possible two random numbers starting at 5. The only numbers randomly produced here would be a 5 or 6.

The Random Seed

There is one other important thing that you should know about random numbers, and that is that they are not entirely random. This has to do with how the computer gets its random numbers from the "random seed."

It is possible, under certain circumstances, to get the same series of random numbers in the same order each time you play the same game. For example, if you turn on the computer, load the same game, and play it in the same order each time, you could get the same series of numbers each time.

But don't worry, there is a way around this. If you will add the following BASIC statement to the beginning of your computer program, it will make it truly different, or random, each time it is run.

```
Ø X=RND(-TI)
```

The Rolling Dice

Now for the fun and games. "Rolling Dice" is a short BASIC program that simulates the rolling of two dice. It produces a nice graphic display and then displays the dice you rolled. The program is a complete "module." In other words, you can add it to one of your programs, or you can write your own game program around it. The important variables are D1 and D2. These variables contain the random numbers for the dice (DIE 1 and DIE 2) each time the dice are "rolled."

For the expanded (8K or more) VIC, change line 1 to read:

```
1 POKE36879,27:SC=4187:CO=37979:X=RND(-T
  I):GOTO1Ø
```

This program uses standard PRINT and POKE statements. Study it carefully, especially lines 112, 114, 116, 160, and 170. These lines are used to generate random numbers. Lines 112 through 116 each generate a random number between 0 and 7, which are used to POKE the colors into the "rolling" dice. Lines 160 and 170 simulate the roll of the dice. Each produces a random number between 1 and 6. To use the program with another program, or to build another program around it, remove line 310, and add what you wish. Happy programming.

Your participation in this monthly column is not only appreciated, but requested. If you have any ideas or questions please write to: VICreations, P.O. Box 5406, Greensboro, NC 27403.

See program listing on page 124.

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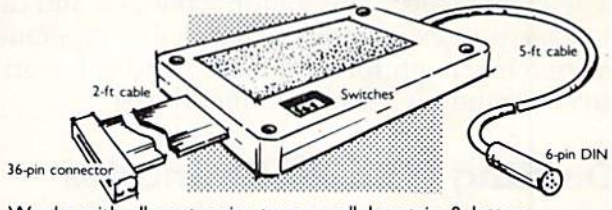

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CHECKBOOK REPORTER

Glen E. Sparks

"Checkbook Reporter," for the unexpanded VIC-20 and Commodore 64, compiles neat printouts of your checking account expenses with the VIC-1525 printer. It also figures if you are over or under budget, or averages your expenditures.

A printer is good for much more than making program listings (which by itself is enough to justify its cost to dedicated programmers). When I first acquired a VIC-1525 printer for my VIC-20, this was one of the first programs I wrote to take advantage of the new accessory.

"Checkbook Reporter" neatly formats your checking expenditures to look something like the monthly statements issued by many banks (see the figure for a sample printout). It can also warn when you exceed your monthly budget, and can average your expenditures for you. The program is written in straightforward BASIC and will work on either the VIC-20 or Commodore 64.

Dealing With Preliminaries

Checkbook Reporter is easy to use. But be sure to familiarize yourself with these instructions:

First, make certain the printer is switched on when you power up your system. All output is automatically sent to the printer, and a ?DEVICE NOT PRESENT ERROR may result if you overlook this routine step.

LOAD and RUN Checkbook Reporter.

The program's first prompt will be "CATEGORY?". Enter an appropriate category for your expenditures (for example, "Utility Bills"). The printer will reproduce this in double-width type to make your report easily identified.

The next prompt is "BUDGET?". Omitting the dollar sign, type in any dollar amount you've determined is your budget limit for the following expenditures. If you have no need for a budget – most of us aren't so lucky – just enter a zero, and the program will bypass its budget section.

Next, the program asks, "AVERAGE?". Respond "YES" or "NO," depending on whether you want your expenditures averaged and printed. (This feature is handy for figuring future budgets.)

For "NUMBER OF ENTRIES?", count the number of checks you want to list and enter that number. As written, the program limits you to 13 entries. This is easily increased, however. Change the DIM statements in lines 54-58 and the addition in lines 113 and 116. Be careful on the VIC, because you may run out of memory if you enter large

Sample Printout Of "Checkbook Reporter"

```
-*-*-*
```

numbers of checks. As listed, Checkbook Reporter consumes 1576 bytes.

Using Checkbook Reporter

At this point, the program has almost all the data it needs to generate the report. The final step is to enter the individual check data.

This section of the program has a series of five repeating questions. The number of times they repeat depends on your answer to "NUMBER OF ENTRIES?".

The first question is "DATE?". Respond with a two-digit number for the day of the month, a three-letter abbreviation of the month, and the last two numerals of the year. "January 1, 1983" would be "01JAN83", and "December 31, 1983" would be "31DEC83." This saves room on the printout.

The second question is "CK NUM?". Enter the check number as all numerals. If this report is for cash payments, then bypass this prompt by pressing RETURN.

The third question is "AMOUNT?". Enter this without the dollar sign, separating dollars and cents with a decimal point. (Challenge to programmers: refine this program to line up the decimal points on the printout.)

The fourth question is "PAID TO?". Enter a short description (15 characters or less) of the party to whom the check was paid.

The fifth and last question is "FOR WHAT?". Enter a short description of the expenditure (up to 25 characters is OK). If more than one item must be listed for one check, separate the items with a slash (unshifted question mark) as you type.

All the data is now entered. However, the program gives you one last chance to make a correction. When it asks "OK?", just press RETURN if you agree. If everything is not OK, type "NO." The program will repeat the five-question loop so you can fix the mistake. You will have to answer all five questions again, not just the one you mistyped.

After completing the five-question loop for each check, the program dumps the report to the printer. Tabs will be reset to produce the correct columns and spacing. If you entered a budget limit, Checkbook Reporter totals your expenditures and reports if you were over, under, or right on budget. If you answered "YES" to "AVERAGE?", Checkbook Reporter adds up all your expenditures and divides by the number of entries to calculate a mean average.

See program listing on page 118.

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States & Capitals Tutor For VIC And 64

Enoch L. Moser

"States & Capitals Tutor," in addition to being a useful tool for students who are learning the American states and capitals, also demonstrates the use of arrays in programs and the storage and retrieval of data on cassette. Both of these concepts are important to programmers, but nonprogrammers may use States & Capitals Tutor without delving into the working details.

"States & Capitals Tutor" asks a student the name of either a state or a capital, and keeps track of correct and incorrect responses. The program randomly decides whether to quiz the student on either states or capitals and also chooses the questions randomly.

Questions answered correctly are not repeated. However, the program *will* repeat questions that are missed. And like any good teacher, States & Capitals Tutor will help students who ask for it. Students who are stumped can simply type "HELP." The program gives the correct answer and comes back to the troublesome question later. It also keeps track of how many times the student asks for help.

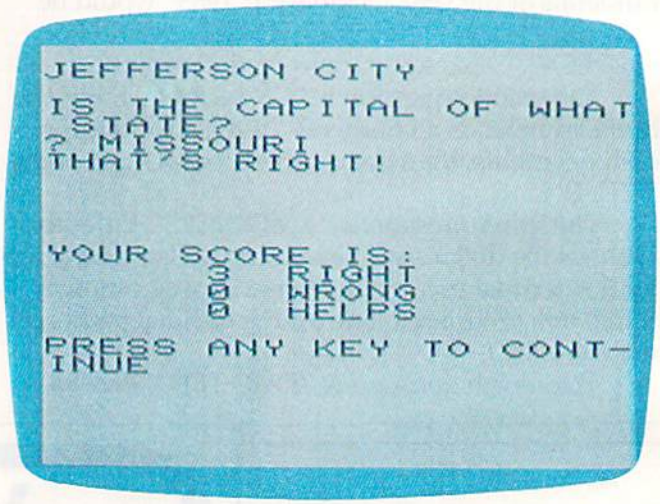
When all 50 states have been correctly matched with their capitals, and if the student has not asked for help or missed any questions, he or she is rewarded with a perfect score message.

A Two-Part Program

The program reads the states and capitals from a tape file which is generated by Program 2, "File Maker."

To use these programs, follow this procedure:

1. Type in Program 1 for the VIC (Program 3 for the 64) and SAVE it on tape. Leave the tape at its position after the SAVE.
2. Type in Program 2 (File Maker). RUN the program. The states and capitals are now on tape under the filename "STATES." Again, leave the tape in its position.



Bone up on geography skills with "States & Capitals Tutor." (VIC-20 version; Commodore 64 similar.)

3. SAVE Program 2.
4. Rewind the tape.
5. LOAD Program 1; leave the PLAY button pressed and the tape in position when loading is complete.
6. RUN Program 1.

If you wish to avoid typing these programs (VIC version only), I will be glad to copy them on tape for you. Send a cassette, a stamped, self-addressed mailer, and $3 to:

Enoch Moser
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How The Programs Work

As mentioned, the File Maker program stores the states and capitals on tape under the filename "STATES." The main program, States & Capitals Tutor, reads this file and stores the data in ST$(I,J), a *two-dimensional array* (more on this in a moment). When a right answer is given, the range of the random number generator (line 100) is decreased by one (line 205), and that state/capital is moved to the top part of the list (lines 180-200), out of the range of selection. Otherwise, the program is fairly straightforward.

The definitions of the variables are:

ST$ (49,1)	States and capitals array.
K	Number of elements moved to top of list.
R1%	State pointer.
R2%	State or capital selector.
AN$	Answer.
RT%	Number right.
WR%	Number wrong.
HE%	Number of helps.
I$	Temporary string for exchanging data.

Arrays

An *array* is simply an ordered set of data. It may have one or more *dimensions*. A one-dimensional array is merely a list whose data elements are numbered starting with 0. For example, a grocery list of 20 items, numbered 0 to 19, would be a one-dimensional array with 20 data elements.

To define an array, you must use a special type of variable called a *subscripted variable*. This takes the form AN(I), where AN is the Array Name and I is the number (subscript) of the desired element. In our grocery list example, if I=19, then AN(I) would be the last item on the list.

The array name may be any legal variable name, with $ (string variable) or % (integer variable) appended if appropriate. (This would indicate that the data contained in the array are strings or integers.)

Let's say you want a one-dimensional array with four elements. The four elements are integers (whole numbers): 21, 23, 25, and 27. The array would be represented by AN%(I). That is to say, AN%(0)=21, AN%(1)=23, AN%(2)=25, and AN%(3)=27.

A *two-dimensional array* is also an ordered list, but one whose elements are each an ordered list themselves. It's easier to understand if you picture it as a chart. For example, a two-dimensional array might look like this:

	I=0	I=1	I=2	I=3
J=0	21	23	25	27
J=1	43	45	47	49
J=2	51	53	58	59

A proper name for this array could be AN% and its elements identified as AN%(I,J). If I=0 and J=0, then AN%(I,J)=21. If I=3 and J=2, then AN%(I,J)=59. The advantage of arrays is that they let you store lots of numbers or other data without using lots of variables, and you can access any data element with a simple mathematical calculation. But be careful: arrays also consume big chunks of memory.

Arrays can become very complicated. It's easy to picture one- and two-dimensional arrays, but how about arrays of three or even four dimensions? Elements of three- and four-dimensional arrays are identified in the form AN%(I,J,K) and AN%(I,J,K,L), respectively.

Creating Arrays

Typically, arrays are created with nested FOR/NEXT loops, each containing a READ from a DATA statement or an INPUT from a storage device. Each FOR/NEXT level creates one ordered list. For example, the following program could be used to define the contents of the two-dimensional array shown above:

```
10 DIM AN%(3,2)
20 FOR I=0 TO 3
30 FOR J=0 TO 2
40 READ AN%(I,J)
50 NEXT J
60 NEXT I
70 DATA 21,43,51,23,45,53,25,47,58,27,49,59
```

The inner (or nested) FOR/NEXT loop (lines 30-50) creates the ordered list of elements in the J-dimension within each element of the I-dimension. Compare the above chart to the DATA statement in line 70 to see how the array is set up.

The DIMension statement (line 10) is required to tell the computer how much memory to set aside for the array. Note that dimension sizes in a DIMension statement are one less than the number of elements in the dimension. The number of dimensions and the number of elements in each dimension are limited only by the amount of memory available.

Remember that an array can hold other types of data besides numbers. States & Capitals Tutor uses a two-dimensional string array, ST$(I,J), to store the 50 states and 50 capitals. See lines 10-35 in Program 2.

Storing Data On Cassette

Data can be added to a program by using DATA statements, keyboard inputs, or from data files stored on tape or disk. Tape or disk files work best when several programs must have access to the same data, or when a program needs several different data files, or when the amount of data you need to store exceeds memory capacity. Note that when arrays are filled from DATA statements, twice as much memory is required as when they are filled from tape or disk.

Storing and retrieving data with cassettes is quite simple if you adhere to a few rules. Most of these rules also apply to disk storage.

First, before information can be written to or read from a file on tape, a communications channel between the computer and recorder must be opened with the OPEN command. This tells the computer which file is involved and in which direction the information will flow (*input* from the recorder into the computer, or *output* from the computer to the recorder). If a write is indicated in the OPEN command, the computer will write a filename on the tape. If a read is indicated, the computer will search for the requested filename

and then read the file.

Second, the file must be closed, after use, by the CLOSE command. This is especially important when creating a new file, because data intended for tape storage is actually written to an area in memory first and transferred to tape only when this area is full. This memory area is called the *cassette buffer*. Some of your data will remain in this buffer after the last write. The CLOSE command transfers the remaining contents of the buffer to tape.

In addition, the number of files that can be open at any one time is limited. Closing files after use is a good habit to develop.

The third rule to watch when storing information on tape or disk is that variable types must be consistent. That is to say, data stored as numeric, integer, or string variables must be read back into variables of the same type. The variable names themselves are not stored, so they can be read back into entirely different variables, as long as you don't mismatch types.

Fourth, data is read back in the same order in which it was written. Therefore, the program must expect the data in exactly the same order in which it will be received.

See program listings on page 119.

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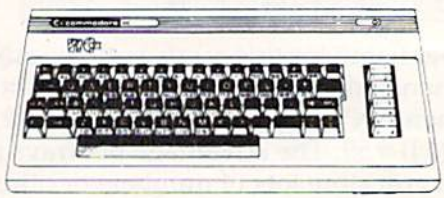

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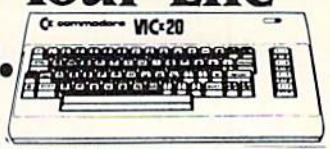

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MiniTerm-20

An Autodialing Terminal Program For The VIC-20

Donald L. Stoner

"MiniTerm-20," a terminal program designed especially for hooking up to services such as CompuServe, can make telecommunicating easier and save you money. It lets you "log-on" or "log-off" at the touch of a key. For more background on using a modem and some of the terminology in this article, see "Telecomputing Today" in this issue.

As soon as I acquired an autodial modem for my VIC-20 (the MicroConnection from Micro-Peripheral Corporation), I decided to try my hand at writing a good terminal program for it. Luckily, Commodore has made it fairly easy to write such a program in BASIC. Buffers and machine language Kernal routines permit input/output through the user port without losing any characters, even with relatively slow BASIC.

However, Commodore also elected to use nonstandard character codes instead of the standard ASCII codes. As a result, additional memory (beyond buffer requirements) must be allocated to convert between Commodore's version of ASCII and the rest of the world.

True, Commodore provides rudimentary terminal software in its *VIC-20 Programmer's Reference Guide* and the documentation which accompanies the VICmodem. But both are intended to show how the computer is programmed and are not written for any particular application.

Specifically, I wanted software that would get me on and off the CompuServe Information Service as quickly as possible to save line charges. "MiniTerm-20" does this within the 3583 bytes of memory available in the unexpanded VIC-20. Even with this limitation, I was able to squeeze in a few "bells and whistles." These include automatic log-on, a cursor, and transmitting control characters. Because of these features, the program is very useful, even if you already have the VICmodem. The autodial feature (for the MicroConnection) was written as a module and can be deleted, if desired, without any reprogramming.

Control Characters

One of the most frustrating obstacles to be overcome during program development was the VIC-20's lack of control characters. The VIC has a control key (CTRL), but it does not send control characters. Control characters are essential when communicating with information services such as CompuServe. For example, the first step when logging onto the network is to send a CTRL-C to trigger its ID and password requests. Thus, it was necessary to create these characters by defining the function keys.

The F1 key now sends a CTRL-C. F3 sends a CTRL-S. The CTRL-S will stop CompuServe transmissions so they can be read before they scroll off the top of the screen. CTRL-Q (the F5 key) tells CompuServe to resume transmission. The fourth key, F7, sends a CTRL-P. This is useful on various *SIGs* (Special Interest Groups of CompuServe) to skip messages.

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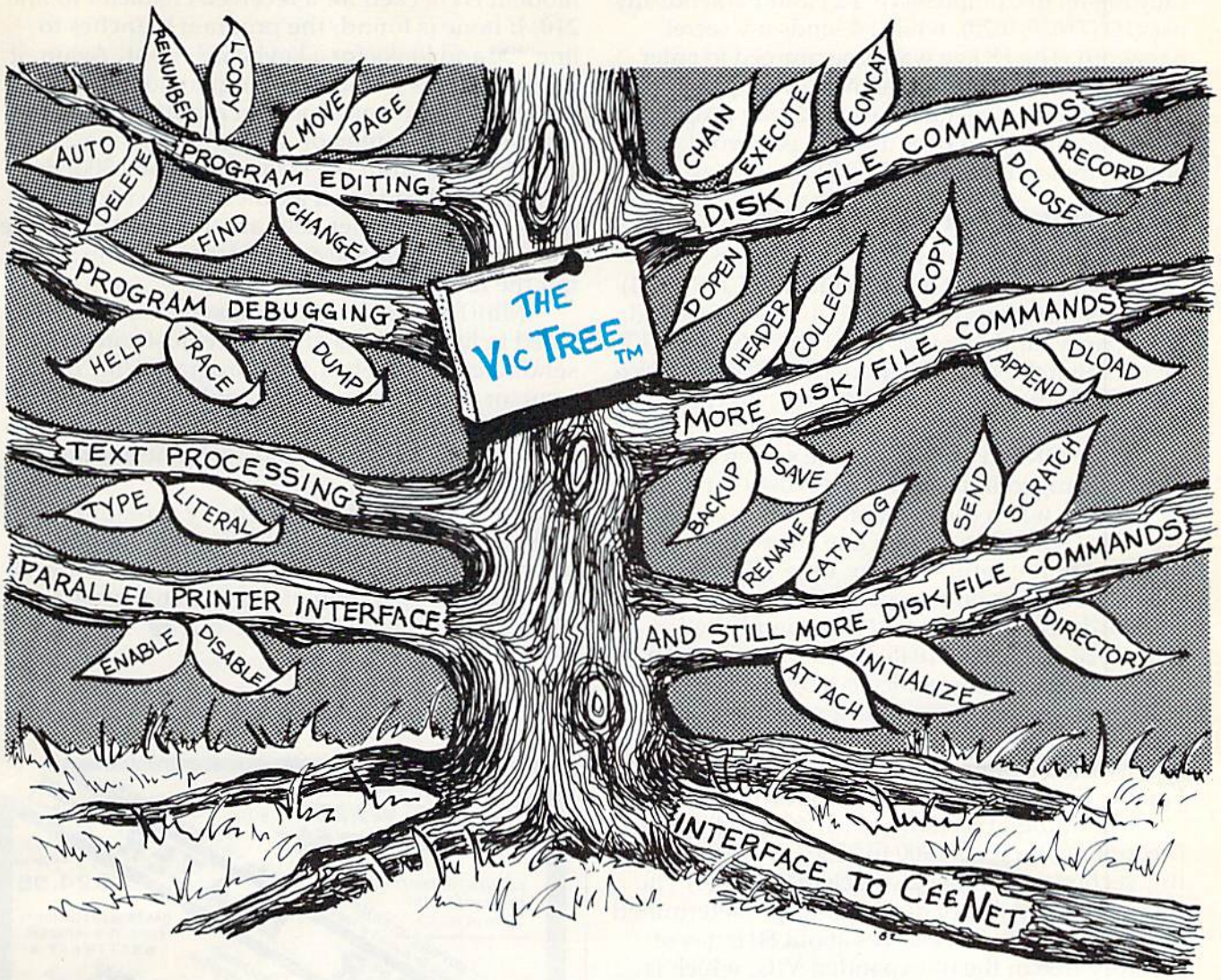

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The shifted function keys are used to automatically log-on to CompuServe. F2 (shift F1) sends my user ID (71625,1620), while F4 sends my secret password. The F8 key was programmed to enter my favorite SIG, while F8 allows me to quickly log-off the system. You must customize the program by substituting your own user ID, password, and other commands in lines 120-150.

How MiniTerm-20 Works

Line 5 opens the user port to the modem. The CHR$(38) selects 300 baud, while the CHR$(224) instructs the computer to send a seven-bit word, even parity, and one stop bit. The POKE to 37136 insures that the autodial modem is off-line. *Delete this POKE if you do not have a MicroConnection modem.*

The POKE in line 10 sets the screen color and can be changed if desired. Lines 20-40 set up the first screen when the program is run.

The GOSUB to 1000 in line 100 routes the program to the setup section. Line 1000 allocates the input/output buffer space. Commodore-to-standard ASCII conversion is accomplished in lines 1020-1040. Line 1045 defines the function keys and determines which control characters will be sent when these keys are pressed. For example, the F1 key normally returns a 133. This is converted by line 1045 to 03, which is a CTRL-C. Finally, line 1050 sets up the input conversion.

The autodial section (which can be eliminated) is contained in lines 1900 to 2550. (If you eliminate this section, you must also delete line 160.) The program is capable of dialing four predetermined phone numbers. This leaves about 80 bytes of memory free in the unexpanded VIC, which is sufficient to avoid "crashes." The stored numbers are contained in P$(1-4) in line 1910. These should be changed to your favorite BBS (Bulletin Board System) or information network access numbers. An area code can be added, if desired.

Lines 1920-1940 display a menu of numbers and provision for manual entry. The selected (or entered) number becomes PH$.

The POKE in line 2030 takes the modem off hook (in other words, it connects the modem to the telephone network) and uses a FOR/NEXT loop to wait approximately two seconds for the dial tone.

Lines 2040-2060 and 2500-2550 do the actual number-dialing by pulsing a relay in the MicroConnection. Once the number has been dialed, the program waits in line 2070 for approximately 30 seconds. If a carrier is received from the remote computer within this period, the value stored at memory location 37136 will change to 237. When this occurs, the program branches to the communications mode in line 200.

The terminal section of the program represents a form of digital "loop-the-loop." The modem is checked for a received character in line 210. If none is found, the program branches to line 300 and looks for a keyboard input. Again, if no character is found, the program loops back to line 210. As soon as a modem input character is received, it is printed on the screen by line 220. If there is input from the keyboard in line 300, the program looks to see if a function key is pressed (lines 320-345). Other keys are transmitted by line 350. Finally, lines 800-840 disassemble and transmit the ID strings.

MiniTerm-20 has one idiosyncrasy that I decided to live with. Each time the host computer sends a carriage return, the program will "drop" a cursor on the screen. This could be corrected by backspacing and erasing the cursor after a carriage return, but this would consume additional memory.

Finally, if additional memory is required (to make room for additional features of your own, for example). Lines 20-40 can be deleted without affecting the operation of the terminal program.

See program listing on page 117.

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TeleTerm 64

A Terminal Program For The Commodore 64

Gregg Peele, Programming Assistant

One of the least-used features of home computers is their ability to communicate with other, even more powerful, computers over any distance. "TeleTerm 64" is a ready-to-type program which allows the Commodore 64 to be used as a *remote terminal* with other systems.

If you've ever seen a large computer system, you may be familiar with the word *terminal*. This refers to a device – usually a keyboard and screen – which is hooked up to a host computer. The terminal communicates with the host computer, sending and receiving data. With a modem and just a little programming, a Commodore 64 can be made to *emulate* (simulate) a terminal – providing low-cost communication with other computer systems.

The modem converts the computer's output into audible tones which are transmitted through telephone lines just like an ordinary phone call. The modem also interprets incoming tones from the other computer as they come through the phone lines – converting them back into the data which the computer can process. The modem thus acts as a two-way interpreter for communication, making it possible for information to travel between computers over standard telephone lines.

A modem cannot do all of this interpreting by itself, however. It needs help from a terminal program. There are many terminal programs on the market with all kinds of special features. The VICmodem even comes with one on cassette. When communicating with different computers, though, it's nice to have more than one terminal program to assure compatibility. If one terminal program doesn't work for some reason, you can try another. Or you can customize a program to work well in a certain situation.

The program included here – "TeleTerm 64" – was designed to be an easy-to-use terminal program for general-purpose telecomputing. It's also designed to be easily customized.

Using TeleTerm 64

Type in the program listing on page 125 and save it twice on tape or disk. Now switch off your computer, hook up the modem, and power up. LOAD and RUN TeleTerm 64. There will be a pause of about 45 seconds as the program sets itself up. When initialized, the program will briefly display READY in the upper-left corner of the screen.

Now dial the distant computer with which you want to communicate. If you're using an acoustic modem, you'll hear a tone which signals that the other computer has answered the phone. With a direct-connect modem, such as the VICmodem, you may have to leave the telephone handset plugged in until you hear the tone, and then quickly unplug the handset and connect the modem.

To get the host computer's attention, press the RETURN key a few times. Usually this will elicit some kind of response from the host computer. Now you're on-line and ready to go.

Customizing TeleTerm 64

You may well discover that TeleTerm 64 needs no customizing at all and works fine as is. If not, perhaps some simple modifications will fix the problem.

To customize our terminal for use with a specific host computer, the special function keys or other keys can be redefined. We can assign them almost any function we want. This is easily done by changing the value of the array member which contains the CHR$( ) ("character string") value of that particular key.

A table of CHR$( ) values is found in Appendix F of the manual which came with the computer, the *Commodore 64 User's Guide*. In TeleTerm 64, the value for outgoing characters is represented by the variable *O%* (the percent symbol means that *O%* is an *integer variable* – a variable which can represent only a whole number, never a fraction). The value for incoming characters is represented by the variable *I%*. These variables are used to assign new functions to the keys.

For example, to make the F1 special function key send out the ASCII backspace code, we need a statement like this:

```
52 O%(133)=8
```

In this case, the statement is already in Tele-

Term 64, at line 52. The statement is easy to grasp. Remember: *O%* represents *outgoing* characters. The number 133 represents the Commodore code for the F1 key, as listed on page 136 in the manual. The number 8 is the standard ASCII code for backspace. Keep in mind that standard ASCII codes vary from Commodore ASCII, so the numbers in Appendix F cannot be used here. Instead, you will have to find an ASCII table in another manual or computer book; it is not included in the *User's Guide* or the *Commodore 64 Programmer's Reference Guide*. (However, a standard ASCII table *is* found on page 274 of the *VIC-20 Programmer's Reference Guide*.)

If you wish to receive characters and make a specific translation to Commodore codes, then use the I% variable in a similar way. Here's how:

```
123 I%(8)=157
```

This statement, also already included in TeleTerm 64, takes the incoming standard ASCII code for backspace (8) and changes it to the Commodore code for cursor-left (157). Thus, when the Commodore 64 receives a character code from the host computer that stands for backspace, it will move the cursor to the left.

How TeleTerm 64 Works

In TeleTerm 64, first we close device #2 (in case it was left open by a previous operation) and clear all variables. This is done in line 1. Next, we use the OPEN statement to open the channel of device #2, and to set parity and baud rate. This is done in line 2 with the added parameters CHR$(6+32)+CHR$(32+64), which specify "no parity" and "300 baud." (See pages 349-353 in the *Commodore 64 Programmer's Reference Guide* for more information about parameters for the RS-232 port.)

Line 6 sets the screen and border colors to black. The next statements convert Commodore codes to standard ASCII. These codes are stored in an array (O%) for later use within the main loop of the program. After this array is complete, another array (I%) is formed by translating the ASCII codes to their equivalent Commodore codes.

With all our translations done, the word "READY" appears on the screen and the keyboard is set in upper/lowercase mode. The main loop of the program now commences. This loop uses the GET command to alternately check the keyboard (device #0) and the serial port where the modem is connected (device #2) to see if a character has been received. If no character has been received by one device, the program checks the other. If any data is received, it is immediately printed on the screen. Since the loop is limited to only four lines, the program runs fast enough to handle incoming data at 300 baud.

See program listing on page 125.

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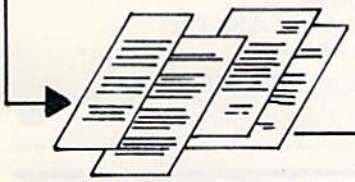

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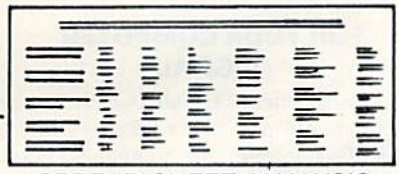

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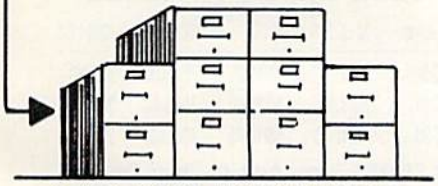

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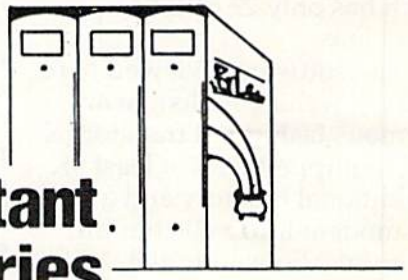

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REVIEWS

Terminal-40 For VIC

Harvey B. Herman, Associate Editor

Because of its low cost and ease of use, the VICmodem is the most popular modem among VIC-20 and Commodore 64 users (see the VICmodem review in this issue). However, the terminal program that comes with the VICmodem is not entirely satisfactory. For one thing, it does not address the short line-length disadvantage of the VIC-20, which has only 22 columns per screen line.

The software reviewed here overcomes this problem in an ingenious fashion. It transforms a VIC equipped with at least 8K of additional memory and a suitable modem into a 40-column communications terminal. Not only that, but *Terminal-40* also provides a fine-scrolling feature – the lines scroll smoothly without any abrupt movement, a feature normally seen only on expensive dedicated terminals.

How does *Terminal-40* transform 22 columns into 40? It may seem like magic, but it is more accurately described as a software-generated character set. With a few look-alike exceptions, each character is defined in an easily readable 3x6 dot matrix. I had a little trouble distinguishing some characters at first, *m* and *n* for example, but I quickly got used to these. It does help, however, to have a sharp display; I used a monitor.

Magic is the word that comes to mind again while watching the smooth-scrolling operation. The fast machine language program is controlling each pixel dot and can move each character smoothly, one pixel at a time, to generate a new line. A well-designed program such as *Terminal-40* is a pleasure to watch and use.

The *Terminal-40* tape requires a special loading sequence which is clearly explained in the excellent 23-page manual.

Start-Up Options

After the program is up and running, a series of options (with default settings) is presented. Your particular situation may require you to change the default settings. Beginners can go astray here, so check with the operator of the remote computer system to be sure. A typical configuration is:

300 baud
line feed off
even parity
7 bits word size

But don't count on it. My local university computer system recently changed to *no parity* after operating for years with *even parity*. Perhaps they like to keep us on our toes.

You can probably guess that I like this program. And I haven't even told you about several other nice touches: a 4K (or larger) receive buffer and programmable function keys for frequently used options. Negative points are minor. The 40-column screen display is in uppercase only, a few characters can be difficult to read at first, and you must go through all the preset options to change just one.

HELP - REPRINT THIS LIST
A - READ ALL MESSAGES
B - BULLETIN SECTION
CONT - TOGGLE CONTINUOUS MODE
DM - DELETE A MESSAGE
DP - DELETE A PROGRAM
DUP - CHANGE ECHOPLEX
E - ENTER A MESSAGE
EXP - EXPERT MODE
F(m) - FORWARD MESSAGE READING
FROM - LIST MESSAGES FROM A USER
G - GOODBYE <SAME AS QUIT>
LF - TURN OFF/ON LINE FEEDS
LIST - LIST AVAILABLE PROGRAMS
LOAD - LOAD A PROGRAM
LOG - SYSTEM USAGE LOG
MINE - LIST MESSAGES YOU SENT
NEW - READ NEW MESSAGES
O - OVERVIEW OF MESSAGES

With Terminal-40, *you can convert your VIC-20 into a 40-column telecomputing terminal.*

Other than those notes, consider this a rave review.

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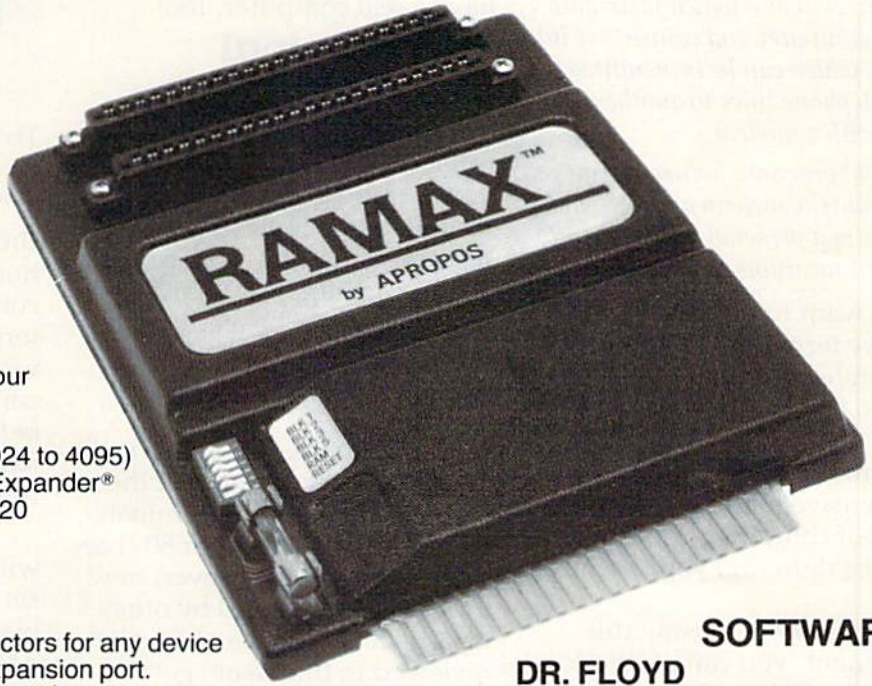

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APROPOS TECHNOLOGY

VICmodem For VIC And 64

Harvey B. Herman, Associate Editor

Modem: A device which takes data from a computer and converts it into signals which can be transmitted over telephone lines to another computer with a modem.

Terminal program: Software required to operate the modem and thereby transform a personal computer into a communications terminal.

If you want to purchase an inexpensive terminal to communicate by telephone with distant computers, try adding a VICmodem to your VIC-20 or Commodore 64. I am not aware of a more inexpensive method to bring the world of computer information services right into your home or office.

For example, using this equipment, you can place a local call to the CompuServe Information Service and find out the latest quote on Commodore stock or the next flight leaving for your favorite vacation spot. The list of services by various companies is expanding rapidly and includes something for everyone.

I do not exaggerate when I say this equipment is inexpensive. Included in the low price is a simple no-frills terminal program which works on the unexpanded VIC, plus one free hour of connect time each on CompuServe, The Source, and the Dow Jones Information Network. Since the combined discounted price of a VIC-20 Computer and the VICmodem is now less than $200, I would estimate that it costs less than half that of any other dedicated terminal/modem on the market today. And you have a real computer, too!

The Terminal Program

You say there must be some catch. Well, there is. Each time you want to use the VIC as a terminal, you must load a terminal program (unless the program is on a cartridge). A dedicated terminal would be ready on power-up. Of course, a dedicated terminal cannot play *GORF*.

Another disadvantage is the 22-character screen line of the VIC. Most dedicated terminals would display 40, 64, or 80 characters on a line. However, new programs introduced by other firms (such as *Terminal-40*, also reviewed in this issue) get around the 22-character limitation using software tricks. And, of course, you get the usual 40-character screen when using the VICmodem with the Commodore 64.

A slick manual comes with the package, but the directions are confusing. Two acquaintances have had trouble using

The VICmodem plugs into the user port of a VIC-20 or Commodore 64. A modular cord then connects it to the telephone.

The Commodore VICmodem is one of the least expensive ways to get started in telecomputing.

the modem because the directions tell you to call the other computer before loading the terminal program. This usually won't work because the other computer will hang up the phone before you can get the program loaded. Here is some advice for the novice:

1. You should have a phone with a detachable modular handset. Elaborate phones with combined dialers and handsets will not work.

2. First, plug the VICmodem into the user port with the power off.

3. Then, turn on the computer and load and run the terminal program.

4. Next, dial the remote computer. When you hear the high-pitched tone, detach the handset and plug its modular cord into the socket on the VICmodem. Complete the remote computer's log-on sequence. Do not hang up the handset until you log off later.

5. I sometimes plug in the phone before I dial and rely on the indicator light to tell me when a successful connection has been made. You might try this method if you are a little slow in switching the modular cord and if the remote computer tends to hang up.

6. If you are having problems with long-distance calls because of low signal levels, as I do, perhaps your telephone company can help. Local telephone calls work just fine for me. However, I sometimes have trouble calling bulletin boards in other cities. This problem is not unique to the VICmodem, but you should be aware of the possibility.

This product is a real bargain which provides an additional dimension to the VIC or 64. I recommend it highly.

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LORES

LGR	HLIN
LCOL	VLIN
LPLOT	

BASIC COMMANDS - HIRES

PLOT	FLIP
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SCREEN	DRAW
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	PSAVE

MISC. COMMANDS

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LARRY ISAACS

Single-Drive Disk Copying

Part 2

This month we'll wrap up the project we started in August: a single-drive disk copy program that lets you back up various kinds of files on your disks. A ready-to-type program listing for this valuable utility is included this month. Also, I'll briefly review a new printer interface for the Commodore 64.

Disk Backups

You'll recall from August that we discussed the necessity – and the difficulties – of backing up programs on disk. With BASIC programs this is no problem. Just LOAD the program into the computer, swap disks, and SAVE. But this won't work with special programs which load via a non-relocating LOAD command, that is, LOAD "FILE",8,1. Among these is the DOS (Disk Operating System) 5.1 program on the master disk that comes with the 1541 disk drive. We discussed what a useful utility this is. It's certainly worth keeping a backup copy of DOS 5.1, but the "COPY/ALL" program on the master disk will not work with DOS 5.1 and other files of this type.

I closed last month's column by promising to give you a single drive file copy program I wrote myself. You'll find it among the program listings in the back of the magazine, on page 123. First, let's cover the instructions for using this copy program. Then, I'll give you a short program and table of numbers which will verify if you've typed in the copy program correctly.

To make it easier to develop this copy program, I allowed a couple of limitations. First, only *program*, *sequential*, and *user* file types may be copied. Second, only files small enough to fit into memory can be copied. This turns out to be files which are less than 32768 bytes in length. Since this utility is intended mainly for copying programs, which have to fit into memory anyway, this size limitation shouldn't be much of a problem.

To use the utility, first load it into memory after typing it in and saving it on disk. Then place the disk which contains the file you want to copy into the drive. Now RUN the copy utility. First the directory will be read into memory, and the first 16 files of the three copyable types will be displayed. You will then be prompted to enter a filename and file type. The name and type should be entered on the same line, separated by a comma. If the file you wish to copy is shown on the screen, you may move the cursor to the line containing the name and press RETURN. Simply pressing RETURN in response to the prompt will display the next 16 filenames and reissue the prompt.

Once the file has been selected, the program will try to read it into memory. If the file is successfully read into memory without error, you will be prompted to place the destination disk into the drive. When the desired disk is in the drive and the drive door is closed, press RETURN. At this point, the file will be written from memory to the destination disk using the same filename as the original. If a file by that name is already present on the disk, you are given a chance to specify a new filename.

Once the copy is made, you will be asked if you want to copy another file. If so, place the desired disk into the drive and press RETURN. If you wish to exit instead, press a key other than RETURN. You may abort the program at any other point by pressing RUN/STOP and RESTORE simultaneously. Unrecognized errors during the copy process also will cause the program to abort with an error message.

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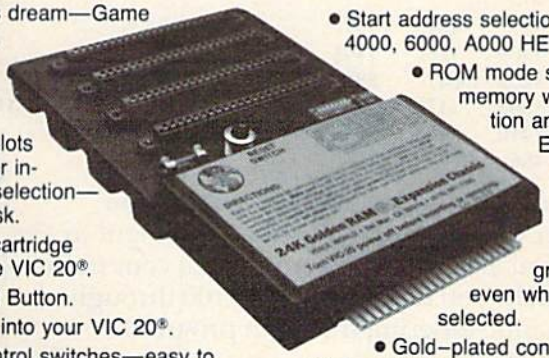

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Notes On The Program

I originally intended the workings of this program to be extremely simple and easy to understand. However, I deviated from this goal in an effort to make it more user-friendly. It may not be clear in some places why I did something a certain way. It shouldn't be too hard in most cases to figure out what is going on.

In the program listing, there are 174 bytes of machine language encoded in DATA statements. This machine code contains three separate routines which are called from BASIC via the USR( ) function. The first routine reads the file into memory and returns the number of bytes read or an error indication. The second routine writes the file from memory to disk and returns the number of bytes written or an error indication. And finally, the third returns individual characters from the file in memory. This third routine is used for displaying the directory. The primary reason for machine language for these functions is to achieve maximum speed, especially for the file read and write functions.

To help verify that the DATA statements are entered correctly, use the following verification procedure. Enter lines 20 through 50 of the main program followed by all the DATA statements. Then enter the following temporary program lines:

```
100 TL=0:FOR I=0 TO 173
110 TL=TL+PEEK(7936+I)
120 T=INT((I+1)/8)*8-1
130 IF T=I THEN PRINT TL,:TL=0
140 NEXT I:PRINT TL
```

Then run the program. This will add the bytes POKEd for each DATA statement and print these totals on the screen in four columns. You can check the numbers printed by your program with those shown below:

```
547     287     1015    987
1184    1589    1287    1145
1263    1163    647     882
1346    1066    1174    1284
1590    1410    1143    583
1110    456
```

If any of the numbers do not match, you should check the associated DATA statement to find the number which is in error. Once your numbers all match, you can delete lines 100 through 140 and resume entering the main program.

Interfacing A Printer

I recently attended the Trenton Computer Festival (I was working a booth, actually) where I purchased a printer interface to connect my Commodore 64 to my NEC-8023 printer. The printer interface I bought was the CARD/? Universal Centronics Printer Interface made by Cardco, Inc., in Wichita, Kansas. The main reason for purchasing this printer interface was that it's one of the less expensive units on the market, plus it was very attractively discounted late Sunday afternoon, just before the show was to close. The normal list price for the CARD/? is $79.95.

The reason such a device is needed is to convert the *serial* output that comes from the 64 to the *parallel* input required by my NEC printer. The difference between serial and parallel is that in serial the binary digits (called bits), which make up binary numbers, are sent sequentially on a single wire, one after the other. In parallel communications, groups of bits are sent together at once, i.e., in parallel.

The actual interface consists of a small box approximately 5.5 inches by 3 inches by 1 inch with cables coming out opposite ends. The cable going to the printer is about 14 inches long and terminates with a standard Centronics parallel connector. The serial cable to go to the 64 (or 1541 disk drive, if one is present) is about six feet long. There is another cable which connects to the cassette port on the 64 to obtain power for the interface. The hookup procedure described in the CARD/? manual indicated that this power connection might be optional. This would imply that the interface might draw power from the printer. However, I found the power connection to the printer cut, so the power connection to the 64 is required. Apparently, the manual hasn't been updated yet. I would hazard a guess that the connection was cut because plugging it into the printer while it is switched on could damage the printer or the interface. If this is true, it would be unwise to reconnect it, even if your printer is able to power the interface.

When I began reading the manual, I was pleasantly surprised at all the features the interface supports. In checking out the interface, I also discovered that its operation didn't quite match what the manual said. I will describe the operation I observed, since the changes appear to be improvements.

CARD/? Features

The CARD/? interface supports five different printing modes. The various modes are selected by the third argument in the OPEN command. This argument is most often called the "secondary address." For example, a command to open a channel to the printer would be:

```
OPEN 4,4,MODE
```

where *MODE* is a variable containing a number from 0 to 8. Actually these five modes may be divided into three basic types, normal printing mode, listing mode, and graphics mode. In normal printing mode a small amount of character translation is done. This translation consists of con-

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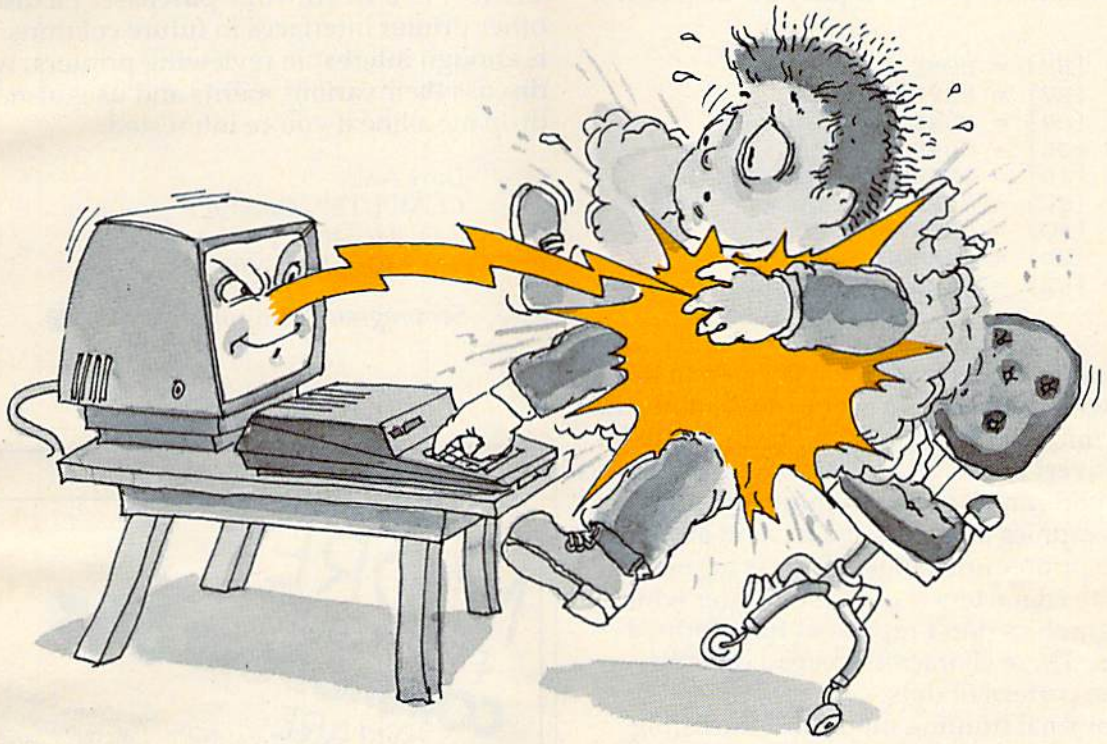

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verting character 15, CHR$(15), to character 20, CHR$(20), and vice versa. This is intended to make most other printers better imitate the VIC printer with respect to enlarged printing.

The listing mode is naturally intended for making listings. In this mode, certain character codes are converted to a four-character sequence when printed. These characters are the screen control characters, which might have an entirely different control function if sent to the printer unchanged. There is a unique four-character sequence for each of these special codes, except for the color control codes, which all print "{CC}". The ones which do print uniquely are as follows:

```
{HM} = HOME
{RV} = REVERSE ON
{CU} = CURSOR UP
{CL} = CURSOR LEFT
{ID} = INSERT or DELETE
{SC} = SCREEN CLEAR
{RO} = REVERSE OFF
{CD} = CURSOR DOWN
{CR} = CURSOR RIGHT
```

This table differs from what is given in the manual, which describes a set of conversions that is not as complete. Higher-priced units might be able to convert the color control codes uniquely as well, but you can't have everything and low cost.

The graphics mode is used to send all characters to the printer unchanged. This is necessary because the characters sent to the printer while printing graphics don't represent fully formed characters. These characters instead directly specify the pattern of dots.

The normal printing mode and the listing mode both allow a selection between uppercase only or upper/lowercase. There is no additional translation involved with the uppercase-only mode, where the upper/lowercase mode converts upper- and lowercase characters as needed to appear correctly on the printer. However, the Commodore graphics characters are not converted, so unless the printer supports Commodore graphics characters, you will see whatever the printer wants to print as that character. Additionally, in the normal printing mode, you may switch from uppercase-only to the upper/lowercase mode by printing a CHR$(17), and vice versa by printing a CHR$(145).

The manual also states that the normal printing and listing modes support selection between automatic line feeds or no automatic line feeds. It appears that this feature was sacrificed to allow more conversions in the listing mode. Actually, this is no sacrifice since the auto line feed can be enabled in the 64 by specifying a logical file number greater than 127. (This logical file number is the first one following the "OPEN".)

The manual that comes with the CARD/?, despite being a little out-of-date, is otherwise good. It contains both reference and tutorial information, and each topic is usually accompanied by an example. There are also a healthy number of appendices, including some examples on using the graphics mode. These examples apply to the Gemini-10 and Epson printers, though they can be adapted to most other printers capable of dot graphics.

At this point, I won't make any comparisons to other printer interfaces, but I would rate the CARD/? as a worthwhile purchase. I'll discuss other printer interfaces in future columns. If there is enough interest in reviewing printers, we can discuss their various merits and uses also. Please drop me a line if you're interested.

Larry Isaacs
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See program listing on page 123.

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64 Searcher

David W. Martin

This month's installment of "Power BASIC" – a continuing series of short machine language routines to enhance your computer's capabilities – is a search utility for Commodore 64 programmers. It was adapted from a similar program for the VIC-20 published in the February 1983 issue of *COMPUTE!*, the *Gazette*'s companion magazine.

Many programmers, when working on a long program, often get lost in their own code. That is, they decide they want to change a certain statement, but they have trouble finding it among the scores or hundreds of other statements. Or perhaps they need to find every occurrence of a certain variable, or a certain number, or a word in PRINT statements or lines of DATA. It's easy to suffer bloodshot eyes when poring laboriously over a program in search of a single statement or character.

That's where "64 Searcher" comes in handy. Let the computer do the tedious work. A short utility program written in machine language can search a BASIC program from top to bottom much faster and easier than human eyes can.

You don't need to know machine language to use 64 Searcher. It's in the form of a BASIC loader which loads the machine language into memory for you. 64 Searcher then waits in an area of normally unused memory (starting at location 49152, or $C000 hexadecimal) until you call for it.

Using 64 Searcher

Enter the program carefully and save it on tape or disk before running it for the first time. The machine language is encoded in the DATA statements, and one typing error may well cause your computer to "lock up" (stop responding). If this happens, you'll have to clear the computer by switching it off and on, which also clears the memory. If you've saved the program, you can then load it and begin hunting for the typing mistake.

Now, load in the BASIC program you want to search (remember, 64 Searcher is still present in protected memory). To use 64 Searcher, type a dummy BASIC line 0, followed by a colon, followed by whatever you want to find. For instance, let's say you want to delete all REM statements from a program to save memory. You want to find every occurrence of REM. You would type:

```
0: REM
```

Press RETURN. Now, type SYS 49152. Press RETURN. In a few moments, 64 Searcher will list all line numbers where REM appears in your BASIC program.

To find all occurrences of a certain variable, such as X$, you would follow the same procedure:

```
0: X$   [press RETURN]
SYS 49152   [and press RETURN]
```

You can use 64 Searcher to find any character or string of characters in your programs. The only limitation is that the SYS command must be executed in *immediate mode*; that is, it cannot be used within a program.

If you do much programming, you should find 64 Searcher a welcome addition to your toolbox of utilities.

See program listing on page 123.

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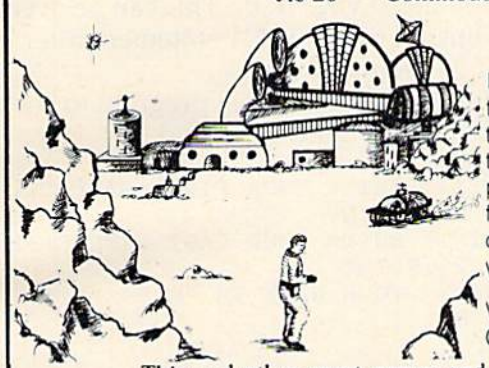

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Better Commodore Input

Mark Walsh

If you've discovered a clever time-saving technique, or a brief but effective programming shortcut, send it in to "Hints & Tips," c/o COMPUTE!'s Gazette *for Commodore. If we use it, we'll pay you $35.*

I have read several articles recently about improving the INPUT feature in Commodore BASIC. One of the main points brought up in these articles was that the BASIC INPUT statement always prompts the user with a question mark. This can be confusing, especially when the prompt or instruction to the user is not a question. I have come across a method of inputting data without the question mark in the prompt.

This technique involves tricking the computer into thinking that it is receiving data from a peripheral. This uses methods similar to reading data from a disk drive or a cassette recorder.

The first step is to OPEN a file and provide the INPUT from there. This is done as follows:

```
10 OPEN 1,0
```

This tells the computer that file number 1 will be communicating with the keyboard. The computer knows this because the device number of the keyboard is 0.

Now if you wish to INPUT something from the keyboard, but don't want the question mark to be displayed, simply use the INPUT# command. The INPUT# command is used to request input from an opened file, in this case the keyboard. The format for this procedure is demonstrated in the following example:

```
10 OPEN 1,0: REM SET COMPUTER TO READ
   DATA FROM KEYBOARD
20 PRINT " INPUT YOUR NAME HERE:";: INPUT#1,
   A$
```

This will print the following on the screen and wait for a response:

```
INPUT YOUR NAME HERE: ■
```

One drawback to this type of INPUT is that the computer does not PRINT a carriage return after you input your data. This can be overcome by adding an extra PRINT statement after the INPUT# command.

Here is a short sample program to show you how to use this INPUT method:

```
10 OPEN 1,0
20 PRINT" ENTER YOUR FIRST NAME:";:INPUT#
   1,N1$:PRINT
30 PRINT" ENTER YOUR LAST NAME:";:INPUT#1
   ,N2$:PRINT
40 PRINT" YOUR NAME IS "N1$" "N2$
50 CLOSE1
60 END
```

Notice that we use the CLOSE 1 statement at the end of the program. This CLOSEs the file that we used to INPUT the data.

Using this INPUT method allows us to input data into the computer without the question mark showing up on the screen. This method will come in handy when you want neat, professional-looking programs that won't confuse the user with a question mark when there is no question. ■

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Using The Function Keys:

A BASIC Tutorial

Charles Brannon, Program Editor

Perhaps you've pressed those function keys to the right of the keyboard and were dismayed to find they did nothing. Don't worry, they work fine; they just need a program to "come alive." With this tutorial, you'll find it's easy to write your own programs using function keys.

One day, somebody had a good idea. There were dozens of programs: word processors, spreadsheets, data bases, and they all required you to press certain keys to perform the various functions. For example, a word processor would save your text to disk with CTRL-S (meaning to hold down a special ConTRoL key while you press S). The arrow keys that move the cursor were among the first "function keys"; they replaced various CTRL-keys that did the same thing.

Mystery Keys

So someone added a number of mysterious keys to a computer keyboard. Dedicated (used only for one task) word processors have special labelled keys to cut, paste, copy, edit, etc. Since computers are general-purpose, the keys had to be unlabelled so every application could do something different with the keys. The idea caught on. These days, function keys are the rage. You can hardly buy a computer without them.

Special, set-aside, unlabelled function keys are defined by whatever program is currently running. Frequently, programmers assign powerful functions to the keys. This gives the user a feeling of power – pressing one key unleashes raw computing power. Of course, it's a gimmick of sorts; it would be just as easy to assign the function to the normally unused CTRL keys (and link them in an easy-to-remember fashion, such as CTRL-Q for Quit, CTRL-E to Erase, etc.). There is undeniable convenience, however, in having your own special "programmable" keys.

The Sad Truth

Fundamentally, the function keys are no different from any other key on the keyboard, so it is as unrealistic to assume they'll always do something as it is to think that pressing the fire button on the joystick will always fire a shot. If you've used the joystick, you know that it tells you only which way the player is pushing (north, south, east, west, or diagonal) and whether the fire button is pressed or not. Period. You have to write (or buy) special programs that move the spaceship based on the position of the joystick.

The function keys on the VIC-20 and Commodore 64 are the same. When you run commercial software, the keys do everything from changing border colors to shifting the screen, selecting difficulty, restarting a game, etc. If you buy the Super Expansion Cartridge, the keys will type out certain BASIC commands for you. You can do the same thing with a program in this issue for the Commodore 64. The November 1982 issue of **COMPUTE!** has a similar article for the VIC ("Programming VIC's Function Keys"), and you'll see more such ready-to-use applications in these pages in upcoming issues. But the real power comes when you understand how to use them in your own programs.

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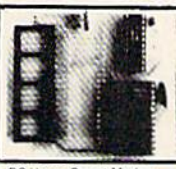

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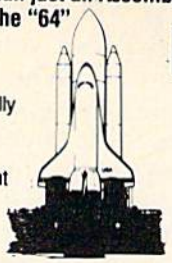

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GETting To The Point

The primary BASIC command used to read the keyboard is GET. When you type GET followed by a variable name (GET A$ or GET XZ), the computer looks at the keyboard and puts whatever key is being pressed into the variable. But it looks only once, and if you didn't press a key, the computer merrily goes on to something else. GET will not wait for a key to be pressed. This is a good feature; but if you do want to wait for a key, you would do something like:

```
10 GET A$
20 IF A$="" THEN 10
```

or

```
10 GET N
20 IF N=0 THEN 10
```

The phrase: IF A$=" " means: if A-string equals the null string (nothing is between the quotes; it's just two quotes in a row), then go back to line 10. So as long as no key is pressed, line 20 will keep sending the computer back to line 10 to check again. The second example is waiting for you to press a number key from 1-9 (it uses 0 to mean no key pressed, so pressing 0 won't make it stop waiting). This type of GET command used with a numeric variable (instead of a string) is dangerous, though. If the user presses any other key, the program will crash (stop running and return to BASIC) with a ?SYNTAX ERROR message. It's just as easy to convert a string into a number with the VAL command, so the second statement could be rephrased:

```
10 GET N$
20 IF N$="" THEN 10
30 N=VAL(N$)
```

It's easy to improve; if you wanted to accept only numbers above, you could change line 20 to:

```
20 IF N$<"0" OR N$>"9" THEN 10
```

which means: if N-string has an ASCII value (a code used in your computer to order characters – A, which has an ASCII value of 65 is "less than" Z, which has an ASCII code of 90) less than that of "0" or greater than that of the character "9" then loop back to line 10.

Incidentally, the ASCII code for the null string (quote-quote) is zero, which is less than 48, the code for "0", so the loop will also wait for a key. If you're curious about ASCII, check out the BASIC commands ASC and CHR$ in your manual. You can also find a table of the ASCII codes and their character equivalents in your user's guide.

Strictly Logical?

So if you just want to accept a yes or no answer (Y for yes, N for No), then this will work just fine:

```
10 GET A$:IF A$<>"Y" AND A$<>"N" THEN 10
```

Computer logic with IF/THEN, AND, OR, and NOT can get a bit tricky, so let me explain this line. The computer will GET a key and put it into A$. Remember that the user may not have pressed the key yet, so A$ could be any key, or it could be the null string (" "). In the latter case, the null string is not equal to "Y" *and* it is not equal to "N", so it will loop back to 10. If you pressed "X", it will also loop. But if you pressed "Y", A$ would be equal to "Y" (meaning A$<>"Y" is false) but it would not equal "N" (A$<>"N" is true). Since both conditions are not true, AND fails, and the program continues. A common mistake would be:

```
10 GET A$:IF A$<>"Y" OR A$<>"N" THEN 10
```

This would loop back to line 10 no matter what key was pressed. If either A$ did not equal "Y" *or* A$ did not equal "N", then the computer would loop. The only way for the test to fail would be for A$ to be "not equal" to "Y" and "not equal" to "N"; in other words, it would have to be both equal to "Y" *and* equal to "N". I told you it was tricky! By the way, another common mistake is something like:

```
10 GET A$:IF A$<>"Y" AND <>"N" THEN 10
```

This will give you a ?SYNTAX ERROR, but it seems to read all right in English. It's just that the computer requires you to repeat the variable for each <>, <,>, =, etc.

If you've tried some of the examples, you'll find that GET only changes the value of the variable. It does not print the key on the screen. This is also handy; you don't want a bunch of keys printed out just to move your spaceship using the keyboard. To make a simple "video typewriter," try this (remember the semicolon on line 20):

```
10 GET X$:IF X$="" THEN 10
20 PRINT X$;:GOTO 10
```

On To Great Frontiers

We're nearly ready to use the function keys. Try this: press the quote (SHIFT-2) and then press the function keys (SHIFT to get the even-numbered keys). What magic is this? Each key now seems to print some cryptic symbol! The computer can read the function keys just like any other key, but PRINTing them won't display anything unless you are in quote mode (where you can program cursor controls into PRINT statements). But you can take advantage of the symbols to easily interpret the function keys. You use GET to read them, of course. Try this program:

```
10 GET F$:IF F$="" THEN 10
20 IF F$="{F1}" THEN PRINT"FUNCTION ONE"
30 IF F$="{F2}" THEN PRINT"FUNCTION TWO"
40 IF F$="{F3}" THEN PRINT"FUNCTION THRE
   E"
50 IF F$="{F4}" THEN PRINT"FUNCTION FOUR
   "
60 IF F$="{F5}" THEN PRINT"OOO! FUNCTION
    FIVE!"
```

```
70 IF F$="{F6}" THEN PRINT"FUNCTION SIX
80 IF F$="{F7}" THEN PRINT"FUNCTION SEVE
   N"
90 IF F$="{F8}" THEN PRINT"FUNCTION EIGH
   T"
```

The {F1}, {F2}, etc., means for you to press the appropriate function key inside the quotes. You'll get the aforementioned symbols. Line 70 (printed on the 1525e printer) would look like:

```
70 IF F$="■" THEN PRINT "FUNCTION SIX"
```

Line 60 is just to remind you that every program has a spark of spontaneity. What will you do with the function keys? It's really up to you. For example, to restart a game, you might do something like this:

```
530 PRINT"PRESS F1 TO PLAY AGAIN"
540 GET A$:IF A$<>"{f1}" THEN 540
```

You could also organize a bunch of subroutines, one for each key, that does something associated with the key (maybe eight sound effects):

```
10 GET RQ$:IF RQ$="" THEN 10
20 IF RQ$="{f1}" THEN GOSUB 500
.
.
90 IF RQ$="{f8}" THEN GOSUB 1000
```

Each function key also has a corresponding ASCII number. Try this program. It prints out the ASCII (ordered) value for any key pressed:

```
10 GET A$:IF A$="" THEN 10
20 PRINT CHR$(34);A$,VAL(A$)
30 GOTO 10
```

The CHR$(34) puts the computer in quote mode so that if you press CLR/HOME or something, you'll see the symbol for it instead of the screen clearing.

Here is a summary of the ASCII values for the function keys:

f1: 133	f2: 137
f3: 134	f4: 138
f5: 135	f6: 139
f7: 136	f8: 140

They're in order from f1-f7, and f2-f8, separately. So you could use a statement like this to check for f6:

```
342 IF F$=CHR$(139) THEN PRINT "Function
   Six"
```

or

```
659 IF ASC(F$)=139 THEN GOSUB 4153
```

See how CHR$ and ASC work?

You Take It From Here

Now that you've got the word on function keys, you can start making your programs "user friendly" too. And you can share a double feeling of power: not only does pressing one key raise your garage door, put out the cat, and make coffee in the morning, but you also know that you're the one that made it do it.

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A Beginner's Guide To Typing In Programs

What Is A Program?

A computer cannot perform any task by itself. Like a car without gas, a computer has *potential*, but without a program, it isn't going anywhere. Most of the programs published in *COMPUTE!'s Gazette* for Commodore are written in a computer language called BASIC. BASIC is easy to learn and is built into all VIC-20s and Commodore 64s.

BASIC Programs

Each month, *COMPUTE!'s Gazette* for Commodore publishes programs for both the VIC and 64. To start out, type in only programs written for your machine, e.g., "VIC Version" if you have a VIC-20. Later, when you gain experience with your computer's BASIC, you can try typing in and converting certain programs from another computer to yours.

Computers can be picky. Unlike the English language, which is full of ambiguities, BASIC usually has only one "right way" of stating something. Every letter, character, or number is significant. A common mistake is substituting a letter such as "O" for the numeral "0", a lowercase "l" for the numeral "1", or an uppercase "B" for the numeral "8". Also, you must enter all punctuation such as colons and commas just as they appear in the magazine. Spacing can be important. To be safe, type in the listings *exactly* as they appear.

Brackets And Special Characters

The exception to this typing rule is when you see the curved bracket, such as "{DOWN}". Anything within a set of brackets is a special character or characters that cannot easily be listed on a printer. When you come across such a special statement, refer to "How To Type In *COMPUTE!'s Gazette* Programs."

About DATA Statements

Some programs contain a section or sections of DATA statements. These lines provide information needed by the program. Some DATA statements contain actual programs (called machine language); others contain graphics codes. These lines are especially sensitive to errors.

If a single number in any one DATA statement is mistyped, your machine could "lock up," or "crash." The keyboard and STOP key may seem "dead," and the screen may go blank. Don't panic – no damage is done. To regain control, you have to turn off your computer, then turn it back on. This will erase whatever program was in memory, *so always SAVE a copy of your program before you RUN it*. If your computer crashes, you can LOAD the program and look for your mistake.

Sometimes a mistyped DATA statement will cause an error message when the program is RUN. The error message may refer to the program line that READs the data. *The error is still in the DATA statements, though.*

Get To Know Your Machine

You should familiarize yourself with your computer before attempting to type in a program. Learn the statements you use to store and retrieve programs from tape or disk. You'll want to save a copy of your program, so that you won't have to type it in every time you want to use it. Learn to use your machine's editing functions. How do you change a line if you made a mistake? You can always retype the line, but you at least need to know how to backspace. Do you know how to enter inverse video, lowercase, and control characters? It's all explained in your computer's manuals.

A Quick Review

1) Type in the program a line at a time, in order. Press RETURN at the end of each line. Use backspace or the back arrow to correct mistakes.

2) Check the line you've typed against the line in the magazine. You can check the entire program again if you get an error when you RUN the program.

3) Make sure you've entered statements in brackets as the appropriate control key (see "How To Type *COMPUTE!'s Gazette* Programs" elsewhere in the magazine.)

We regret that we are not able to respond to individual inquiries about programs, products, or services appearing in COMPUTE!'s Gazette *for Commodore due to increasing publication activity. On those infrequent occasions when a published program contains a typo, the correction will appear in the magazine, usually within eight weeks. If you have specific questions about items or programs which you've seen in* COMPUTE!'s Gazette *for Commodore, please send them to Gazette Feedback, P.O. Box 5406, Greensboro, NC 27403.*

How To Type In *COMPUTE!'s Gazette* Programs

Many of the programs which are listed in *COMPUTE!'s Gazette* contain special control characters (cursor control, color keys, inverse video, etc.). To make it easy to know exactly what to type when entering one of these programs into your computer, we have established the following listing conventions.

Generally, any VIC-20 or Commodore 64 program listings will contain bracketed words which spell out any special characters: {DOWN} would mean to press the cursor down key. {5 SPACES} would mean to press the space bar five times.

To indicate that a key should be *shifted* (hold down the SHIFT key while pressing the other key), the key would be underlined in our listings. For example, S would mean to type the S key while holding the shift key. This would appear on your screen as a "heart" symbol. If you find an underlined key enclosed in braces (e.g., {10 N}), you should type the key as many times as indicated (in our example, you would enter ten shifted N's).

If a key is enclosed in special brackets, [k], you should hold down the *Commodore key* while pressing the key inside the special brackets. (The Commodore key is the key in the lower left corner of the keyboard.) Again, if the key is preceded by a number, you should press the key as many times as necessary.

Rarely, you'll see a solitary letter of the alphabet enclosed in braces. These characters can be entered on the Commodore 64 by holding down the CTRL key while typing the letter in the braces. For example, {A} would indicate that you should press CTRL-A. You should never have to enter such a character on the VIC-20, but if you do, you would have to leave the quote mode (press RETURN and cursor back up to the position where the control character should go), press CTRL-9 (RVS ON), the letter in braces, and then CTRL-0 (RVS OFF).

About the *quote mode*: you know that you can move the cursor around the screen with the CRSR keys. Sometimes a programmer will want to move the cursor under program control. That's why you see all the {LEFT}'s, {HOME}'s, and {BLU}'s in our programs. The only way the computer can tell the difference between direct and programmed cursor control is the quote mode.

Once you press the quote (the double quote, SHIFT-2), you are in the quote mode. If you type something and then try to change it by moving the cursor left, you'll only get a bunch of reverse-video lines. These are the symbols for cursor left. The only editing key that isn't programmable is the DEL key; you can still use DEL to back up and edit the line. Once you type another quote, you are out of quote mode.

You also go into quote mode when you INSerT spaces into a line. In any case, the easiest way to get out of quote mode is to just press RETURN. You'll then be out of quote mode and you can cursor up to the mistyped line and fix it.

Use the following table when entering cursor and color control keys:

When You Read:	Press:	See:	When You Read:	Press:	See:	When You Read:	Press:	See:
{CLEAR}	SHIFT CLR/HOME		{CYN}	CTRL 4		[7]	C 7	
{HOME}	CLR/HOME		{PUR}	CTRL 5		[8]	C 8	
{UP}	SHIFT ↑ CRSR ↓		{GRN}	CTRL 6		{F1}	f1	
{DOWN}	↑ CRSR ↓		{BLU}	CTRL 7		{F2}	f2	
{LEFT}	SHIFT ← CRSR →		{YEL}	CTRL 8		{F3}	f3	
{RIGHT}	← CRSR →		[1]	C 1		{F4}	f4	
{RVS}	CTRL 9		[2]	C 2		{F5}	f5	
{OFF}	CTRL 0		[3]	C 3		{F6}	f6	
{BLK}	CTRL 1		[4]	C 4		{F7}	f7	
{WHT}	CTRL 2		[5]	C 5		{F8}	f8	
{RED}	CTRL 3		[6]	C 6				

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Demon Star

BEFORE TYPING...

Before typing in programs, please refer to "How To Type COMPUTE!'s Gazette Programs" and "A Beginner's Guide To Typing In Programs" that appear before the Program Listings.

Program 1: Demon Star – VIC Version (Main Program)

```
1 POKE36879,253:PRINT"{CLR}WAIT"
2 P=28:POKE56,P:POKE52,P:POKE51,PEEK(55)
  :CLR
3 FORI=7168TO7679:POKEI,PEEK(I+32768-716
  8):NEXT
4 OPEN1,1,0,"DF"
5 INPUT#1,X:IFX=999THEN7
6 FORJ=XTOX+7:INPUT#1,Y:POKEJ,Y:NEXT:GOT
  O5:DIMMX%(2,2),O%(4)
7 CLOSE1:PT=0:BB=1000:INPUT "LEVEL (1-10
  )";SK:IFSK<1ORSK>10THEN7
8 D0=37154:D1=D0-3:D2=D0-2:CD=30720:C=22
  :R=23:SP=32:FL=0:RG=8
9 V=36878:VN=V-1:VS=V-2:E=42
10 FORI=0TO2:FORJ=0TO2:SP=SP+1:MX%(I,J)=
  SP:NEXTJ,I:SP=32
11 DEFFNA(W)=7680+X+C*Y:DEFFNB(W)=PEEK(F
  NA(W)):DEFFNR(W)=INT(RND(1)*W)
12 PRINT"{CLR}":POKEV+3,128:POKEV+1,14:P
  OKEV-9,255
13 FORI=0TO3:O%(I)=E:E=E+1:NEXT:K=4:FORH
  =0TO3:FORJ=1TO(3*SK):GOSUB70
14 POKERP,O%(H):POKERC,K:NEXTJ:K=K+1:NEX
  TH
15 MC=0:MR=-1:SX=3:SY=22:SH=8167:POKESH,
  36:POKESH+CD,3
16 FORT=128TO24STEP-1:POKEV+3,T:FORD=1TO
  10:NEXTD,T:FORH=1TO1000:NEXT
17 PRINT"{HOME}{WHT}"PT"{BLU}":IFFL=0AND
  FNR(10)=3THEN63
18 IFFL=2THENPRINT"{HOME}{DOWN}{GRN} ";R
  IGHT$(TI$,2);"{BLU}":IFTI>700THEN72
20 GOSUB60:IFFBTHENX=SX:Y=SY:PX=MC:PY=MR
  :GOTO34
21 U=0:W=0:IFJ0THENU=1
22 IFJ2THENU=-1
23 IFJ1THENW=1
24 IFJ3THENW=-1
25 IFU=0ANDW=0THENU=MC:W=MR
26 MC=U:MR=W:SX=SX+MC:SY=SY+MR:IFSY<0THE
  NSY=R
27 IFSY>RTHENSY=0
28 IFSX>21THENSX=0
29 IFSX<0THENSX=21
30 X=SX:Y=SY:J=FNB(0):IFJ<48ANDJ>41THENF
  L=1:GOTO45
31 POKESH,SP:POKESH+CD,0:SH=FNA(0):POKES
  H,MX%(MC+1,MR+1):POKESH+CD,3
32 IFFL<>2THENPRINT"{HOME}{DOWN}{BLK}
  {3 SPACES}{BLU}"
33 GOTO17
34 FORI=1TORG:POKEV,15:X=X+PX:Y=Y+PY:POK
  EVS,241
35 IFI<>1THENPOKET,SP:POKET+CD,0
36 IFX>21THENX=0
37 IFX<0THENX=21
38 IFY>RTHENY=0
39 IFY<0THENY=R
40 J=FNB(0):IFJ=SPTHEN42
41 IFJ<48ANDJ>41THENI=RG:NEXTI:GOTO45
42 T=FNA(0):POKET,37:POKET+CD,1:POKEV,0:
  FORH=1TO25:NEXTH:NEXTI
43 POKET,SP:POKET+CD,0:IFPEEK(RP)=47THEN
  POKEV,15
44 GOTO17
45 L=FNB(0):XP=FNA(0):IFFL=1THEN50
46 IFL=47THENPT=PT+500:FL=0:RG=8:GOTO50
47 IFL<46ANDL>41THENPT=PT+((L-41)*5)
48 IFL=46THENPT=PT+100:FL=0
49 IFPEEK(RP)=47THEN52
50 POKEXP,58:POKEXP+CD,2:POKEVN,220
51 FORM=15TO0STEP-1:POKEV,M:FORN=1TO25:N
  EXTN,M:POKEVN,0:POKEVS,0
52 FORM=1TO3:POKEXP,58:POKEXP+CD,2:FORN=
  1TO25:NEXTN:POKEXP,SP:POKEXP+CD,0
53 FORN=1TO25:NEXTN,M:IFFL=1THEN56
54 IFPT>BBTHEN67
55 POKET,32:POKET+CD,0:GOTO17
56 POKEVN,0:POKEV-9,240:POKEV+1,170:IFPT
  <0THENPRINT"{CLR}{BLK}ENERGY LOSS: ";
  PT:GOTO58
57 PRINT"{CLR}{BLK}SHIP DESTROYED. ENERG
  YTRANSMITTED: ";PT
58 INPUT"ANOTHER GAME{SHIFT-SPACE}(Y/N)
  ";A$:IFA$="Y"THEN7
59 END
60 POKED0,127:P=PEEK(D2)AND128:J0=-(P=0)
  :POKED0,255
61 P=PEEK(D1):J1=-((PAND8)=0):J2=-((PAND
  16)=0)
62 J3=-((PAND4)=0):FB=-((PANDSP)=0):RETU
  RN
63 GOSUB70:IFRP<7706THENGOSUB70:POKERP,4
  7:POKERC,6:POKEVN,241:GOSUB75:RG=5:GO
  TO65
64 POKERP,46:POKERC,2:POKEV-4,197
65 POKEVS,0:POKEV,15:FORH=1TO200:NEXT:PO
  KEV-4,0
66 FL=2:TI$="000000":GOTO18
67 POKEVS,0:POKEVN,0:PRINT"{CLR}{YEL}BON
  US 100":FORH=1TO1000:NEXT
68 PT=PT+100:BB=BB+1000:IFPT>3000ANDSK<8
  THENSK=SK+1
69 GOTO8
70 X=FNR(C):Y=FNR(R):IFFNB(0)<>SPTHEN70
71 RP=FNA(0):RC=RP+CD:RETURN
72 POKEV,0:IFPEEK(RP)=47THEN56
73 POKERP,SP:POKERC,0:PT=PT-500:IFPT<0TH
  EN56
74 PRINT"{HOME}{BLK}{6 SPACES}":FL=0:GOT
  O17
75 FORI=1TO6:POKEV+1,30:FORJ=1TO30:NEXT:
  POKEV+1,14:FORJ=1TO30:NEXT:NEXTI:RETU
  RN
```

Program 2: VIC Data File Program

```
10 OPEN1,1,1,"DF"
20 READX:IFX<0THEN50
30 PRINT#1,X
40 GOTO20
50 CLOSE1
60 GOTO999
100 DATA7432,128,126,121,112,104,68,64,32
```

```
110 DATA7440,6,8,16,252,252,16,8,6
120 DATA7448,32,64,68,104,112,121,126,12
    8
130 DATA7456,24,24,24,24,60,90,153,129
140 DATA7464,0,0,36,24,24,36,0,0
150 DATA7472,129,153,90,60,24,24,24,24
160 DATA7480,1,126,158,14,22,34,2,4
170 DATA7488,96,16,8,63,63,8,16,96
180 DATA7496,4,2,34,22,14,158,126,1
190 DATA7504,128,82,164,80,21,170,21,34
200 DATA7512,24,60,98,73,93,89,50,4
210 DATA7520,0,42,28,62,28,42,0,0
220 DATA7528,0,112,152,188,189,25,14,0
230 DATA7536,60,66,129,153,153,129,66,60
240 DATA7544,56,16,84,254,84,16,56,0
250 DATA7632,162,116,124,56,60,106,81,14
    4
260 DATA999,-1
999 END
```

Program 3: Demon Star — 64 Version

```
90 S=54272:FOR I=0TO28:POKES+I,0:NEXT
100 RESTORE
110 POKE53281,11:POKE53280,11:PRINT"
    {CLR}{WHT}HOLD ON A FEW SECONDS WHIL
    E I GET MYSELF"
120 PRINT"TOGETHER..."
130 POKE 56334,PEEK(56334)AND254:POKE1,P
    EEK(1)AND251
140 IF PEEK(14934)<>56 THEN FORI=12288TO
    14935:POKEI,PEEK(I+53248-12288):NEXT
150 FOR I=12552TO12679:READ A:POKEI,A:NE
    XT
160 POKE1,PEEK(1)OR4:POKE56334,PEEK(5633
    4)OR1
170 DIMMX%(2,2),O%(4)
180 K(1)=3:K(2)=10:K(3)=13:K(4)=7
190 PT=0:BB=1000:INPUT "LEVEL (1-10)
    {3 RIGHT}5{3 LEFT}";SK:IFSK<1ORSK>10
    THEN190
200 D2=56321:D1=D0-3:D2=D0-2:CD=54272:C=
    40:R=24:SP=32:FL=0:RG=10
210 E=42
220 FORI=0TO2:FORJ=0TO2:SP=SP+1:MX%(I,J)
    =SP:NEXTJ,I:SP=32
230 DEFFNA(W)=1024+X+C*Y:DEFFNB(W)=PEEK(
    FNA(W)):DEFFNR(W)=INT(RND(1)*W)
240 PRINT"{CLR}"
250 POKE 53272,(PEEK(53272)AND240)+12
260 FORI=0TO3:O%(I)=E:E=E+1:NEXT:K=1:FOR
    H=0TO3:FORJ=1TO(3*SK):GOSUB820
270 POKERP,O%(H):POKERC,K(K):NEXTJ:K=K+1
    :NEXTH
280 MC=0:MR=-1:SX=3:SY=24:SH=1987:POKESH
    ,36:POKESH+CD,3
290 FORH=1TO1000:NEXT
300 PRINT"{HOME}{WHT}{RVS}"PT"{BLU}":IFF
    L=0ANDFNR(10)=3THEN750
310 IFFL=2THENPRINT"{HOME}{RVS}{DOWN}
    {CYN} ";RIGHT$(TI$,2);"{BLU}":IFTI>1
    000THEN840
320 GOSUB720:IFFBTHENX=SX:Y=SY:PX=MC:PY=
    MR:GOTO460
330 U=0:W=0:IFJ0THENU=1
340 IFJ2THENU=-1
350 IFJ1THENW=1
360 IFJ3THENW=-1
370 IFU=0ANDW=0THENU=MC:W=MR
380 MC=U:MR=W:SX=SX+MC:SY=SY+MR:IFSY<0TH
    ENSY=R
390 IFSY>RTHENSY=0
400 IFSX>39THENSX=0
410 IFSX<0THENSX=39
420 X=SX:Y=SY:J=FNB(0):IFJ<48ANDJ>41THEN
    FL=1:GOTO570
430 POKESH,SP:POKESH+CD,0:SH=FNA(0):POKE
    SH,MX%(MC+1,MR+1):POKESH+CD,3
440 IFFL<>2THENPRINT"{HOME}{DOWN}{BLK}
    {3 SPACES}{BLU}"
450 GOTO300
460 FORI=1TORG:X=X+PX:Y=Y+PY
470 IFI<>1THENPOKET,SP:POKET+CD,0
480 IFX>39THENX=0
490 IFX<0THENX=39
500 IFY>RTHENY=0
510 IFY<0THENY=R
520 J=FNB(0):IFJ=SPTHEN540
530 IFJ<48ANDJ>41THENI=RG:NEXTI:GOTO570
540 T=FNA(0):POKET,37:POKET+CD,1:POKEV,0
    :FORH=1TO25:NEXTH:NEXTI
550 POKET,SP:POKET+CD,0:IFPEEK(RP)=47THE
    NREM
560 GOTO300
570 L=FNB(0):XP=FNA(0):IFFL=1THEN620
580 IFL=47THENPT=PT+500:FL=0:RG=10:GOTO6
    20
590 IFL<46ANDL>41THENPT=PT+((L-41)*5)
600 IFL=46THENPT=PT+100:FL=0
610 IFPEEK(RP)=47THEN640
620 POKEXP,58:POKEXP+CD,1
630 FORM=15TO0STEP-1:FORN=1TO25:NEXTN,M
640 FORM=1TO3:POKEXP,58:POKEXP+CD,1:FORN
    =1TO25:NEXTN:POKEXP,SP:POKEXP+CD,0
650 FORN=1TO25:NEXTN,M:IFFL=1THEN680
660 IFPT>BBTHEN790
670 POKET,32:POKET+CD,0:GOTO300
680 IFPT<0THENPOKE 53272,21:PRINT"{CLR}
    {BLK}{WHT}ENERGY LOSS: ";PT:GOTO700
690 POKE 53272,21:PRINT"{CLR}{BLK}{WHT}S
    HIP DESTROYED.":PRINT"ENERGY TRANSMI
    TTED: ";PT
700 POKE 198,0:INPUT"{3 DOWN}ANOTHER GAM
    E{SHIFT-SPACE}(Y/N) {3 RIGHT}Y
    {3 LEFT}";A$:IFA$="Y"THEN190
710 END
720 P=255-PEEK(56321):J0=-((PAND8)=8)
730 J1=-((PAND2)=2):J2=-((PAND4)=4)
740 J3=-((PAND1)=1):FB=-((PAND16)=16):RE
    TURN
750 GOSUB820:IFRP<1068THENGOSUB3000:POKE
    RP,47:POKERC,1:GOSUB870:RG=6:GOTO770
760 GOSUB2000:POKERP,46:POKERC,1
770 FORH=1TO200:NEXT
780 FL=2:TI$="000000":GOTO310
790 POKE 53272,21:PRINT"{CLR}{YEL}BONUS
    100":FORH=1TO1000:NEXT:POKE53272,28
800 PT=PT+100:BB=BB+1000:IFPT>3000ANDSK<
    8THENSK=SK+1
810 GOTO200
820 X=FNR(C):Y=FNR(R):IFFNB(0)<>SPTHEN82
    0
830 RP=FNA(0):RC=RP+CD:RETURN
840 IFPEEK(RP)=47THEN680
850 POKERP,SP:POKERC,0:PT=PT-500:IFPT<0T
    HEN680
860 PRINT"{HOME}{BLK}{6 SPACES}":FL=0:GO
    TO300
870 RETURN
```

```
880 DATA 128,126,121,112,104,68,64,32
890 DATA 6,8,16,252,252,16,8,6
900 DATA 32,64,68,104,112,121,126,128
910 DATA 24,24,24,24,60,90,153,129
920 DATA 0,0,36,24,24,36,0,0
930 DATA 129,153,90,60,24,24,24,24
940 DATA 1,126,158,14,22,34,2,4
950 DATA 96,16,8,63,63,8,16,96
960 DATA 4,2,34,22,14,158,126,1
970 DATA 128,82,164,80,21,170,21,34
980 DATA 24,60,98,73,93,89,50,4
990 DATA 0,42,28,62,28,42,0,0
1000 DATA 0,112,152,188,189,25,14,0
1010 DATA 60,66,129,153,153,129,66,60
1020 DATA 56,16,84,254,84,16,56,0
1030 DATA 162,116,124,56,60,106,81,144
2000 REM SOUND WHEN DEATH STAR APPEARS
2010 POKE 54296,15
2020 POKE 54277,20
2030 POKE 54278,175
2040 POKE 54276,33
2050 FORI=1TO7:POKE 54273,RND(1)*256:NEX
     T
2060 POKE 54276,32
2065 POKE 54296,0
2070 RETURN
3000 GOSUB2000:GOTO 820
```

Potholes

Note: The unusual characters found in lines 10030-10070 of Programs 2 and 3 represent the left-arrow key, found in the upper left corner of the VIC and 64 keyboard.

Program 1: Initialization (For VIC-20)

```
10 POKE 51,0:POKE 52,27
20 POKE 55,0:POKE 56,27:CLR
30 FOR I=6912 TO 6930
40 READ A:POKE I,A:NEXT
50 SYS 6912
60 FOR I=7384 TO 7439
70 READ A:POKE I,A:NEXT
80 POKE 52,28:POKE 56,28:CLR
90 PRINT"{CLR}{DOWN}{RIGHT}INITILIZE COM
   PLETE"
100 PRINT"{3 DOWN}{RIGHT} LOAD MAIN PROG
    RAM"
110 NEW
120 DATA 162,0,189,0
130 DATA 128,157,0,28
140 DATA 189,0,129,157
150 DATA 0,29,232,208
160 DATA 241,96,0
170 DATA 84,124,84,16,16,186,254,186
180 DATA 186,254,186,16,16,84,124,84
190 DATA 14,228,78,254,254,78,228,14
200 DATA 112,39,114,127,127,114,39,112
210 DATA 0,0,24,24,24,0,0,0
220 DATA 0,0,0,0,0,0,0,0
230 DATA 170,85,170,85,170,85,170,85
250 DATA 0,0,0,0,0,0,0,0
```

Program 2: Main Program (For VIC-20)

```
100 POKE 36869,255
110 GOSUB 20000:GOTO 1010
300 GETD$:P=PEEK(203):IF P=64 THEN HA=4:
    RETURN
310 IF P=51 THEN P=0:GOTO 360
320 IF P=36 THEN P=1:GOTO 360
330 IF P=43 THEN P=2:GOTO 360
340 IF P=44 THEN P=3:GOTO 360
350 RETURN
360 IF PEEK(A+M(P))=33 THEN RETURN
370 HA=P:RETURN
400 IF HB<>4 THEN B1=B+M(HB)
402 IF CN>0 THEN RETURN
403 IF CN=0 THEN HB=4:RETURN
405 HY=INT((B-VR+1)/22)-INT((A-VR+1)/22)
410 HX=B-A-HY*22:CN=3
420 IF ABS(HX)>ABS(HY) THEN 450
430 IF HY>=0 THEN HB=0:RETURN
440 HB=1:RETURN
450 IF HX>0 THEN HB=2:RETURN
460 HB=3:RETURN
500 IF HA=4 THEN RETURN
510 A1=A+M(HA):D=PEEK(A1)
520 IF D=32 THEN RETURN
530 IF D=31 THEN 560
540 IF D=33 THEN HA=4:RETURN
550 OV=1:RETURN
560 POKE SU,251:S=S+TE:POKE SU,219:PO=PO
    -1
570 POKE 214,3:S$=STR$(S):SL=LEN(S$):PRI
    NT SPC(22-SL)MID$(S$,2,SL-1)
580 POKE SU,0:RETURN
600 IF HB=4 THEN RETURN
610 B1=B+M(HB):D=PEEK(B1)
620 IF D=32 OR D=31 THEN RETURN
630 OV=1:RETURN
1000 GOTO 6000
1010 GOSUB 10000
1020 GOSUB 1100:GOSUB 1200
1040 IF OV=1 THEN 1700
1050 IF PO=0 THEN 1500
1060 GOTO 1020
1100 IF HA<>4 THEN POKE A,32:A=A1:POKE A
     ,CH(HA):POKE A+CR,2
1110 GOSUB 300:GOSUB 500
1120 RETURN
1200 IF HB<>4 THEN POKE B,UN:POKE B+CR,7
     :B=B1:UN=PEEK(B):POKE B,CH(HB):POKE
      B+CR,6
1210 CN=CN-1
1220 GOSUB 400:GOSUB 600
1230 RETURN
1500 GOSUB 1100:POKE 214,15:PRINT""SPC(1
     6)"BONUS"
1510 BO=TE*20:S=S+BO:TE=TE+5
1520 PRINT SPC(16)BO
1530 GOSUB 3000:FOR I=0 TO 500:NEXT:GOTO
      1010
1700 GOSUB 1100
1710 POKE B,32:POKE A,42
1720 GOSUB 3200
1730 CA=CA-1:OV=0:IF CA=0 THEN 4000
1740 GOTO 1010
3000 FOR SL=0 TO 20
3010 POKE SU,242:FOR S1=0 TO 40:NEXT
3020 POKE SU,245:FOR S1=0 TO 20:NEXT:NEXT
3030 POKE SU,0:RETURN
```

```
3100 FOR SL=0 TO 30
3110 POKE SU,214:FOR S1=0 TO 10:NEXT
3120 POKE SU,221:FOR S1=0 TO 10:NEXT:NEX
     T
3130 POKE SU,0:RETURN
3200 FOR SL=15 TO 0 STEP-1
3210 POKE 36878,SL
3220 POKE SU+3,241:FOR S1=0 TO 9:NEXT:PO
     KE A+CR,4
3230 POKE SU+3,246:FOR S1=0 TO 9:NEXT:PO
     KE A+CR,1:NEXT
3240 POKE SU+3,0
3250 POKE 36878,10:RETURN
4000 GOSUB 3100
4001 PRINT"{HOME}{DOWN}"
4010 FOR S1=0 TO 18
4020 PRINT"{RIGHT}{13 SPACES}":NEXT
4030 POKE 214,6
4031 PRINT"{2 DOWN}{RIGHT}{GRN}* GAME OV
     ER *"
4040 IF S>HS THEN HS=S:PRINT"{2 DOWN}
     {2 RIGHT}{CYN}TOP SCORE..."
4050 PRINT"{3 DOWN}{BLU}{2 RIGHT}TRY AGA
     IN?"
4060 PRINT SPC(7)"{DOWN}<Y/N>"
4070 POKE 214,10:S$=STR$(HS):SL=LEN(S$)
4071 PRINT"{2 DOWN}"SPC(22-SL)MID$(S$,2,
     SL-1)
6000 GET D$:IF D$=""THEN 6000
6010 IF D$="Y" THEN 6100
6020 IF D$="N" THEN POKE 36869,240:PRINT
     "{CLR}{BLK}":END
6030 IF D$="{CLR}" THEN RUN
6040 GOTO 6000
6100 CA=3:S=0:TE=5
6110 GOTO 1010
10000 PRINT"{CLR}{RED} ** POTHOLES **"
10010 PRINT"{YEL}!!!!!!!!!!!!!!!!"
10020 FOR I=0 TO 5
10030 PRINT"!<<<<<<<<<<<<<!"
10040 PRINT"!<!!<!!<!!<!!<!"
10050 PRINT"!<!!<!!<!!<!!<!":NEXT
10060 PRINT"!<<<<<<<<<<<<<!"
10065 PRINT"!!!!!!!!!!!!!!!!"
10070 PRINT"{RIGHT}< {BLU}="TE;TAB(10)"
      {GRN}["CA;
10080 PRINT"{HOME}{BLU}{3 DOWN}"SPC(16)"
      SCORE"
10090 S$=STR$(S):SL=LEN(S$):PRINT SPC(22
      -SL)MID$(S$,2,SL-1)
10100 PRINT"{4 DOWN}"SPC(17)"HIGH"
10110 PRINT"{DOWN}"SPC(16)"SCORE"
10120 S$=STR$(HS):SL=LEN(S$):PRINT SPC(2
      2-SL)MID$(S$,2,SL-1)
10130 A=45+VR:B=453+VR:UN=31
10140 POKE A,28:POKE A+CR,2
10150 POKE B,27:POKE B+CR,6
10200 HA=4:HB=4:PO=150:CN=20
10210 PRINT"{HOME}{3 DOWN}":RETURN
20000 DIM M(3),CH(3)
20010 VR=7680:CR=30720:CA=3:SU=36874:TE=
      5:OV=0
20020 RESTORE:FOR I=0 TO 3:READ M(I),CH(
      I):NEXT
20030 DATA -22,27,22,28,-1,29,1,30
20040 POKE 36878,10
20050 RETURN
```

Program 3: Potholes – 64 Version

```
70 POKE 53280,1:POKE53281,1
80 PRINT"{CLR}{BLK}HOLD ON A SECOND WHIL
   E I GET MYSELF{5 SPACES}TOGETHER..."
90 RESTORE:FOR I=0 TO 8: READ A:NEXT
91 POKE 56334,PEEK(56334)AND254
92 POKE1,PEEK(1)AND251
93 FOR I=0 TO 511:POKE12288+I,PEEK(53248
   +I):NEXT
94 POKE 1,55:POKE 56334,PEEK(56334)OR1
95 I=12505
96 READ A:IF A<>256 THEN POKE I,A:I=I+1:
   GOTO96
99 POKE 53272,28
110 GOSUB 20000:GOTO 1010
300 GETD$:P=PEEK(203):IF P=64 THEN HA=4:
    RETURN
310 IF P=30 THEN P=0:GOTO 360
320 IF P=36 THEN P=1:GOTO 360
330 IF P=29 THEN P=2:GOTO 360
340 IF P=37 THEN P=3:GOTO 360
350 RETURN
360 IF PEEK(A+M(P))=33 THEN RETURN
370 HA=P:RETURN
400 IF HB<>4 THEN B1=B+M(HB)
402 IF CN>0 THEN RETURN
403 IF CN=0 THEN HB=4:RETURN
405 HY=INT((B-VR+1)/40)-INT((A-VR+1)/40)
410 HX=B-A-HY*40:CN=3
420 IF ABS(HX)>ABS(HY) THEN 450
430 IF HY>=0 THEN HB=0:RETURN
440 HB=1:RETURN
450 IF HX>0 THEN HB=2:RETURN
460 HB=3:RETURN
500 IF HA=4 THEN RETURN
510 A1=A+M(HA):D=PEEK(A1)
520 IF D=32 THEN RETURN
530 IF D=31 THEN 560
540 IF D=33 THEN HA=4:RETURN
550 OV=1:RETURN
560 S=S+TE:PO=PO-1
570 POKE 214,3:S$=STR$(S):SL=LEN(S$):PRI
    NT SPC(22-SL)MID$(S$,2,SL-1)
580 RETURN
600 IF HB=4 THEN RETURN
610 B1=B+M(HB):D=PEEK(B1)
620 IF D=32 OR D=31 THEN RETURN
630 OV=1:RETURN
1000 GOTO 6000
1010 GOSUB 10000
1020 GOSUB 1100:GOSUB 1200
1040 IF OV=1 THEN 1700
1050 IF PO=0 THEN 1500
1060 GOTO 1020
1100 IF HA<>4 THEN POKE A,32:A=A1:POKE A
     ,CH(HA):POKE A+CR,2
1110 GOSUB 300:GOSUB 500
1120 RETURN
1200 IFHB<>4THENPOKEB,UN:POKE B+CR,7:B=B
     1:UN=PEEK(B):POKE B,CH(HB):POKE B+C
     R,14
1210 CN=CN-1
1220 GOSUB 400:GOSUB 600
1230 RETURN
1500 GOSUB 1100:POKE 214,15:PRINT""SPC(1
     6)"BONUS"
1510 BO=TE*20:S=S+BO:TE=TE+5
1520 PRINT SPC(16)BO
```

```
1530 GOSUB 3000:FOR I=0 TO 500:NEXT:GOTO
     1010
1700 GOSUB 1100
1710 POKE B,32:POKE A,42
1720 GOSUB 3200
1730 CA=CA-1:OV=0:IF CA=0 THEN 4000
1740 GOTO 1010
3000 FOR SL=0 TO 20
3010 FOR S1=0 TO 40:NEXT
3020 FOR S1=0 TO 20:NEXT:NEXT
3030 RETURN
3100 FOR SL=0 TO 30
3110 FOR S1=0 TO 10:NEXT
3120 FOR S1=0 TO 10:NEXT:NEXT
3130 RETURN
3200 FOR SL=15 TO 0 STEP-1
3220 FOR S1=0 TO 9:NEXT:POKE A+CR,4
3230 FOR S1=0 TO 9:NEXT:POKE A+CR,1:NEXT
3250 RETURN
4000 GOSUB 3100
4001 PRINT"{HOME}{DOWN}"
4010 FOR S1=0 TO 18
4020 PRINT"{RIGHT}{13 SPACES}":NEXT
4030 POKE 214,6
4031 PRINT"{2 DOWN}{RIGHT}{GRN}* GAME OV
     ER *"
4040 IF S>HS THEN HS=S:PRINT"{2 DOWN}
     {2 RIGHT}{CYN}TOP SCORE..."
4050 PRINT"{3 DOWN}{BLU}{2 RIGHT}TRY AGA
     IN?"
4060 PRINT SPC(7)"{DOWN}<Y/N>"
4070 POKE 214,10:S$=STR$(HS):SL=LEN(S$)
4071 PRINT"{2 DOWN}"SPC(22-SL)MID$(S$,2,
     SL-1)
6000 GET D$:IF D$=""THEN 6000
6010 IF D$="Y" THEN 6100
6020 IF D$="N" THEN PRINT"{CLR}{BLK}":EN
     D
6030 IF D$="{CLR}" THEN RUN
6040 GOTO 6000
6100 CA=3:S=0:TE=5
6110 GOTO 1010
10000 PRINT"{CLR}{RED} ** POTHOLES **"
10010 PRINT"{YEL}!!!!!!!!!!!!!!!!"
10020 FOR I=0 TO 5
10030 PRINT"!<<<<<<<<<<<<<!
      "
10040 PRINT"!<!!<!!<!!<!!<!"
10050 PRINT"!<!!<!!<!!<!!<!":NEXT
10060 PRINT"!<<<<<<<<<<<<<!
      "
10065 PRINT"!!!!!!!!!!!!!!!!"
10070 PRINT"{RIGHT}< {BLU}="TE;TAB(10)"
      {GRN}["CA;
10080 PRINT"{HOME}{BLU}{3 DOWN}"SPC(16)"
      SCORE"
10090 S$=STR$(S):SL=LEN(S$):PRINT SPC(22
      -SL)MID$(S$,2,SL-1)
10100 PRINT"{4 DOWN}"SPC(17)"HIGH"
10110 PRINT"{DOWN}"SPC(16)"SCORE"
10120 S$=STR$(HS):SL=LEN(S$):PRINT SPC(2
      2-SL)MID$(S$,2,SL-1)
10130 A=81+VR:B=813+VR:UN=31
10140 POKE A,28:POKE A+CR,2
10150 POKE B,27:POKE B+CR,14
10200 HA=4:HB=4:PO=150:CN=20
10210 PRINT"{HOME}{3 DOWN}":RETURN
20000 DIM M(3),CH(3)
20010 VR=1024:CR=54272:CA=3:TE=5:OV=0
20020 RESTORE:FOR I=0 TO 3:READ M(I),CH(
      I):NEXT
20030 DATA -40,27,40,28,-1,29,1,30
20040 POKE 36878,10
20050 RETURN
30000 DATA 84,124,84,16,16,186,254,186
30010 DATA 186,254,186,16,16,84,124,84
30020 DATA 14,228,78,254,254,78,228,14
30030 DATA 112,39,114,127,127,114,39,112
30040 DATA 0,0,24,24,24,0,0,0
30050 DATA 0,0,0,0,0,0,0,0
30060 DATA 170,85,170,85,170,85,170,85
30070 DATA 0,0,0,0,0,0,0,0,256
```

MiniTerm-20

BEFORE TYPING...

Before typing in programs, please refer to "How To Type COMPUTE!'s Gazette Programs" and "A Beginner's Guide To Typing In Programs" that appear before the Program Listings.

```
5 OPEN2,2,3,CHR$(38)+CHR$(224):POKE37136
  ,98
10 POKE36879,137:PRINT"{CLR}"
20 PRINT"{HOME}{3 DOWN}DDDDDDDDDDDDDDDDD
   DDDDD"
30 PRINT"{BLK}MINITERM-20 FOR VIC-20"
40 PRINT"{DOWN}DDDDDDDDDDDDDDDDDDDDDD"
100 GOSUB 1000
120 ID$(1)="71625,1620"
130 ID$(2)="JOHN DOE"
140 ID$(3)="GO CEM-450"
150 ID$(4)="OFF"
160 GOTO1900
200 PRINTCHR$(147)+CHR$(14)+"ON LINE":PR
    INTCHR$(187);
210 GET#2,A$:IFA$=""THEN300
220 PRINTCHR$(157);CHR$(I%(ASC(A$)));CHR
    $(187);:IFI%(ASC(A$))=34THENPOKE212,
    0
230 GOTO210
300 GETA$:IFA$=""THEN210
320 IFA$=CHR$(137)THENS=1:GOTO800
330 IFA$=CHR$(138)THENS=2:GOTO800
340 IFA$=CHR$(139)THENS=3:GOTO800
345 IFA$=CHR$(140)THENS=4:GOTO800
350 PRINT#2,CHR$(O%(ASC(A$)));:GOTO210
800 FORX=1TOLEN(ID$(S))
810 T$=MID$(ID$(S),X,1)
820 PRINT#2,CHR$(O%(ASC(T$)));
830 NEXT:PRINTCHR$(13):PRINT#2,CHR$(13)
840 IFA$=CHR$(140)THENPRINT"TERMINATING
    CONNECTION":FORX=1TO2000:NEXTX:POKE3
    7136,98:END
850 GOTO210
1000 DIMI%(255),O%(255)
1020 FORZ=32TO64:O%(Z)=Z:NEXT:O%(13)=13:
     O%(20)=8:O%(160)=32
1030 FORZ=65TO90:Y=Z+32:O%(Z)=Y:NEXT:FOR
     Z=91TO95:O%(Z)=Z:NEXT
1040 FORZ=193TO218:Y=Z-128:O%(Z)=Y:NEXT
1045 O%(133)=03:O%(134)=19:O%(135)=17:O%
     (136)=16
```

```
1050 FORZ=0TO255:Y=O%(Z):IFY<>0THENI%(Y)
     =Z
1060 NEXT:RETURN
1900 PRINTCHR$(147)+CHR$(14)
1910 P$(1)="4479012":P$(2)="6341713":P$(
     3)="7638879":P$(4)="7238131"
1920 FORX=1TO4:PRINTX;+"-"+P$(X):NEXT
1930 PRINT" 5 -MANUAL ENTRY"
1940 PRINT:PRINT" SELECTION ?"
1950 GETB$:IFB$=""THEN1950
1960 IFB$="1"THENPH$=P$(1)
1962 IFB$="2"THENPH$=P$(2)
1964 IFB$="3"THENPH$=P$(3)
1966 IFB$="4"THENPH$=P$(4)
1970 IFB$="5"GOTO2010
1980 GOTO2030
2010 PRINT:PRINT"ENTER PHONE NUMBER":INP
     UTPH$
2020 IFLEN(PH$)<7THEN2010
2030 PRINT:PRINT"DIALING...":POKE37136,1
     00:FORX=1TO1000:NEXTX
2040 FORPN=1TOLEN(PH$)
2050 NN=VAL(MID$(PH$,PN,1))
2060 GOSUB2500:NEXTPN
2070 FORDL=1TO2000:IFPEEK(37136)=237THEN
     200
2075 NEXTDL
2080 POKE37136,98
2090 PRINT:PRINT"NO CONNECTION FOR NR."
2100 PRINT:PRINTPH$:FORX=1TO2000:NEXTX:G
     OTO1900
2500 PRINTNN;:IFNN=0THENNN=10
2510 FORX=1TONN
2520 POKE37136,98:FORXX=1TO45:NEXTXX
2530 POKE37136,100:FORXX=1TO24:NEXTXX
2540 NEXTX
2550 FORDL=1TO200:NEXTDL:RETURN
```

Checkbook Reporter

BEFORE TYPING...

Before typing in programs, please refer to "How To Type COMPUTE!'s Gazette Programs" and "A Beginner's Guide To Typing In Programs" that appear before the Program Listings.

```
20 REM CHECKBOOK REPORTER
23 OPEN4,4
26 PRINT"{CLR}"
29 INPUT"CATEGORY";X$
30 PRINT
32 PRINT"TYPE 0 IF NO BUDGET"
35 INPUT"BUDGET";BG
36 PRINT
37 PRINT
38 PRINT"TYPE YES OR NO"
40 PRINT
41 PRINT"DO YOU WANT THE TOTAL";
42 PRINT
44 INPUT"AVERAGED";WAC$
47 PRINT"{CLR}"
50 PRINT"*LIMIT OF 13 ENTRIES*"
53 INPUT"NUMBER OF ENTRIES";VAR
54 DIMA$(15)
55 DIMB(15)
56 DIMC(15)
57 DIMD$(15)
58 DIME$(15)
71 FORA=1TOVAR
74 PRINT"#";A;
77 INPUT"DATE";A$(A)
80 INPUT"CK NUM";B(A)
83 INPUT"AMOUNT";C(A)
86 INPUT"PAID TO";D$(A)
89 INPUT"FOR WHAT";E$(A)
90 REM EDITOR STEP BACKFOR CORRECTIONS
91 INPUT"OK";OK$
92 IFOK$="NO"THENA=A-1:A=A
96 PRINT
97 NEXTA
98 GOTO131
101 FORI=1TOVAR
104 PRINTC(I)
107 GOSUB158
110 NEXTI
113 X=C(0)+C(1)+C(2)+C(3)+C(4)+C(5)+C(6)
    +C(7)+C(8)+C(9)+C(10)
116 GT=X+C(11)+C(12)+C(13)
119 PRINT
122 PRINT"TOTAL="GT
125 REM SEND TO PRINTER
128 GOTO176
131 PRINT#4,"-*-*-*-*-*-*-*-*-*-*-*-*-*-
    *-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-
    *-*-*-"
134 PRINT#4,CHR$(14)X$
137 PRINT#4,CHR$(15)
140 PRINT#4,CHR$(16)"01DATE";
143 PRINT#4,CHR$(16)"10CK NUM";
146 PRINT#4,CHR$(16)"20AMOUNT";
149 PRINT#4,CHR$(16)"30PAID TO";
152 PRINT#4,CHR$(16)"46FOR WHAT"
153 PRINT#4,"-------------------------
    ----------------------"
155 GOTO101
158 PRINT#4,CHR$(16)"01"A$(I);
161 PRINT#4,CHR$(16)"10"B(I);
164 PRINT#4,CHR$(16)"20"C(I);
167 PRINT#4,CHR$(16)"30"D$(I);
170 PRINT#4,CHR$(16)"46"E$(I)
173 RETURN
176 REMGRAND TOTAL AND AVERAGE
179 PRINT#4,CHR$(16)"07GRAND TOTAL="GT
182 REM BUDGET
185 IFBG=0THEN215
186 REM BUDGET ROUTINE
188 PRINT#4,CHR$(16)"12 BUDGET"BG
191 IFBG>GTTHEN200
194 IFBG<GTTHEN206
197 IFBG=GTTHEN212
200 PRINT#4,CHR$(16)"07UNDER BUDGET"BG-G
    T
203 GOTO215
206 PRINT#4,CHR$(16)"08OVER BUDGET"GT-BG
209 GOTO215
212 PRINT#4,"-EXACTLY ON BUDGET-"
215 REM AVERAGE
218 IFWAC$="NO"THEN227
221 Q=GT/VAR
224 PRINT#4,CHR$(16)"06AVERAGE COST="Q
227 PRINT#4,"-*-*-*-*-*-*-*-*-*-*-*-*-*-
    *-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-"
```

States & Capitals Tutor

Program 1:
States Tutor (Main Program) — VIC Version

```
5 OPEN 1,1,0,"STATES"
10 DIM ST$(49,1)
15 FOR I=0 TO 49
20 FOR J=0 TO 1
25 INPUT#1,ST$(I,J)
30 NEXT J
35 NEXT I
40 CLOSE 1
45 K=0:RT%=0:WR%=0:HE%=0
48 PRINTCHR$(147)
50 PRINT"STATES TUTOR"
55 PRINT:PRINT"THIS PROGRAM TUTORS
   {3 SPACES}THE STUDENT IN STATES AND C
   APITALS"
60 PRINT:PRINT"IF YOU DON'T KNOW AN
   {2 SPACES}ANSWER,TYPE 'HELP'"
65 PRINT:PRINT"PRESS ANY KEY TO CONT-INU
   E"
70 GET A$:IF A$=""THEN70

100 R1%=INT((50-K)*RND(-RND(0)))
105 R2%=INT(2*RND(1))
110 PRINTCHR$(147)
115 IF R2%=0 THEN 130
120 PRINT"THE CAPITAL OF ":PRINTST$(R1%,
    0);" IS"
125 GOTO 140
130 PRINTST$(R1%,1):PRINT:PRINT"IS THE C
    APITAL OF WHAT STATE?"
140 INPUT AN$
145 IF AN$=ST$(R1%,R2%)THEN170
150 IF AN$="HELP"THEN220
155 GOTO 250
170 RT%=RT%+1
175 PRINT"THAT'S RIGHT!"
180 FOR I=0TO1
185 I$=ST$((49-K),I)
190 ST$((49-K),I)=ST$(R1%,I)
195 ST$(R1%,I)=I$

200 NEXTI
205 K=K+1
210 GOTO 300
220 HE%=HE%+1
225 PRINT:PRINT"THE ANSWER IS..."
230 PRINTSPC(5)ST$(R1%,R2%)
235 GOTO 300
250 WR%=WR%+1
255 PRINT:PRINT"SORRY.THE CORRECT ANS-WE
    R IS "
260 PRINT:PRINTSPC(5)ST$(R1%,R2%)
300 PRINT:PRINT:PRINT:PRINT
305 PRINT"YOUR SCORE IS:"
310 PRINTSPC(5)RT%;" RIGHT"
315 PRINTSPC(5)WR%;" WRONG"
320 PRINTSPC(5)HE%;" HELPS"
325 IF RT%=50THEN400
330 PRINT:PRINT"PRESS ANY KEY TO CONT-IN
    UE"
335 GET A$:IF A$=""THEN 335
340 GO TO 100

400 IF WR%+HE%=0THEN430
405 PRINT"THAT'S ALL. BUT NOT{3 SPACES}A
    LL YOUR ANSWERS WERE CORRECT OR I HA
    D TO{3 SPACES}HELP YOU."
408 PRINT"PRESS ANY KEY TO START OVER"
410 GET A$:IF A$=""THEN410
415 GOTO45
430 PRINT:PRINT"YOU DID IT!!!!!"
435 PRINT"A PERFECT SCORE AND I DIDN'T H
    ELP"
440 PRINT:PRINT"PRESS ANY KEY TO START O
    VER"
445 GET A$:IF A$=""THEN 445
450 GOTO 45
```

Program 2:
File Maker (Data File) — VIC And 64

```
10 DIM ST$(49,1)
15 FOR I=0 TO 49
20 FOR J=0 TO 1
25 READ ST$(I,J)
30 NEXTJ
35 NEXTI
40 OPEN 1,1,1,"STATES"
45 FOR I=0 TO 49
50 FOR J=0 TO 1
55 PRINT#1,ST$(I,J)
60 NEXT J
65 NEXT I
70 CLOSE 1
75 DATA ALABAMA,MONTGOMERY,ALASKA,JUNEAU
   ,ARIZONA,PHOENIX,ARKANSAS,LITTLE ROCK
80 DATA CALIFORNIA,SACRAMENTO,COLORADO,D
   ENVER,CONNECTICUT,HARTFORD,DELAWARE,D
   OVER
85 DATA FLORIDA,TALLAHASSEE,GEORGIA,ATLA
   NTA,HAWAII,HONOLULU,IDAHO,BOISE
90 DATA ILLINOIS,SPRINGFIELD,INDIANA,IND
   IANAPOLIS,IOWA,DES MOINES,KANSAS,TOPE
   KA
95 DATA KENTUCKY,FRANKFORT,LOUISIANA,BAT
   ON ROUGE,MAINE,AUGUSTA,MARYLAND,ANNAP
   OLIS
100 DATA MASSACHUSETTS,BOSTON,MICHIGAN,L
    ANSING,MINNESOTA,SAINT PAUL,MISSISSI
    PPI,JACKSON
110 DATA MISSOURI,JEFFERSON CITY,MONTANA
    ,HELENA,NEBRASKA,LINCOLN,NEVADA,CARS
    ON CITY
115 DATA NEW HAMPSHIRE,CONCORD,NEW JERSE
    Y,TRENTON,NEW MEXICO,SANTA FE,NEW YO
    RK,ALBANY
120 DATA NORTH CAROLINA,RALEIGH,NORTH DA
    KOTA,BISMARCK,OHIO,COLUMBUS
125 DATA OKLAHOMA,OKLAHOMA CITY,OREGON,S
    ALEM,PENNSYLVANIA,HARRISBURG
130 DATA RHODE ISLAND,PROVIDENCE,SOUTH C
    AROLINA,COLUMBIA,SOUTH DAKOTA,PIERRE
135 DATA TENNESSEE,NASHVILLE,TEXAS,AUSTI
    N,UTAH,SALT LAKE CITY,VERMONT,MONTPE
    L?IER
140 DATA VIRGINIA,RICHMOND,WASHINGTON,OL
    YMPIA,WEST VIRGINIA,CHARLESTON,WISCO
    NSIN,MADISON
145 DATA WYOMING,CHEYENNE
```

Program 3: States Tutor – 64 Version

For the 64 version, substitute the following lines into Program 1.

```
55 PRINT:PRINT"THIS PROGRAM TUTORS THE ST
    UDENT IN{6 SPACES}STATES AND CAPITALS
    "
65 PRINT:PRINT"PRESS ANY KEY TO CONTINUE"
255 PRINT:PRINT"SORRY.THE CORRECT ANSWER
     IS "
330 PRINT:PRINT"PRESS ANY KEY TO CONTINUE
    "
405 PRINT"THAT'S ALL. BUT NOT ALL YOUR AN
    SWERS"
406 PRINT"WERE CORRECT OR I HAD TO HELP Y
    OU."
```

The Beginner's Corner

BEFORE TYPING...

Before typing in programs, please refer to "How To Type COMPUTE!'s Gazette Programs" and "A Beginner's Guide To Typing In Programs" that appear before the Program Listings.

Program 1: VIC Bouncing Ball

```
5 POKE 36878,15
10 PRINT "{CLR}{BLU}"
20 PRINT "PRESS {GRN}RETURN{BLU} TO STOP
   {2 SPACES}THE BOUNCING BALL."
30 PRINT "{3 DOWN}{GRN}{22 +}"
40 I=1:J=14:DI=1:DJ=1
50 POKE 7680+I+22*J,81
60 POKE 38400+I+22*J,2
70 POKE 7680+I+22*J,32
80 I=I+DI:IF I=0 OR I=21 THEN DI=-DI:POK
   E 36876,231
90 J=J+DJ:IF J=7 OR J=22 THEN DJ=-DJ:POK
   E 36876,235
100 POKE 36876,0
110 GET A$:IF A$=""THEN 50
120 IF ASC(A$)<>13 THEN 50
130 PRINT "{CLR}{BLU}"
140 END
```

Program 2: 64 Bouncing Ball

```
5 POKE 53281,1:POKE53280,12
10 PRINT "{CLR}{BLU}"
20 PRINT "PRESS {GRN}RETURN{BLU} TO STOP
   {2 SPACES}THE BOUNCING BALL."
30 PRINT "{3 DOWN}{GRN}{40 +}"
40 I=1:J=14:DI=1:DJ=1
50 POKE 1024+I+40*J,81
60 POKE 55296+I+40*J,2
70 POKE 1024+I+40*J,32
80 I=I+DI:IF I=0 OR I=39 THEN DI=-DI
90 J=J+DJ:IF J=7 OR J=24 THEN DJ=-DJ
110 GET A$:IF A$=""THEN 50
120 IF ASC(A$)<>13 THEN 50
130 PRINT "{CLR}{BLU}"
140 END
```

Program 3: Defend For The VIC

```
1 POKE36878,15:TS=0
2 DEF FNR(X)=7745+22*(INT(RND(0)*20)):GO
  TO 200
10 PRINT"{CLR}":POKE36879,107:N=7922:SC=
   0:D=10
20 POKEN,90
22 I=FNR(X):J=FNR(X):K=FNR(X):H=FNR(X)
24 IFH=IORH=JORH=KORI=JORI=KORJ=K THEN 2
   2
25 POKEH,42:POKEI,42:POKEJ,42:POKEK,42
30 GETA$:IFA$=CHR$(136)OR A$=CHR$(32)THE
   N 60
32 IFA$=CHR$(94)THENPOKEN,32:N=N-22:GOTO
   90
34 IFA$=CHR$(17)THENPOKEN,32:N=N+22:GOTO
   90
35 L=L+1:IFL<DTHEN30
36 H=H-1:I=I-1:J=J-1:K=K-1:L=0
37 IF(H-7680)/22=INT((H-7680)/22)THEN100
38 IF(I-7680)/22=INT((I-7680)/22)THEN100
40 IF(J-7680)/22=INT((J-7680)/22)THEN100
42 IF(K-7680)/22=INT((K-7680)/22)THEN100
44 POKE36876,240:POKEH+1,32:POKEI+1,32:P
   OKEJ+1,32:POKEK+1,32:POKEH,42:POKEI,4
   2:POKEJ,42:POKEK,42:POKE36876,0
50 GOTO30
60 FORM=200TO220:POKE36876,M:POKEN+30720
   ,2:POKEN+30720,1:NEXT:POKE36876,0
62 IFH>NANDH<N+22THEN72
64 IFI>NANDI<N+22THEN74
66 IFJ>NANDJ<N+22THEN76
68 IFK>NANDK<N+22THEN78
70 SC=SC-5:GOTO82
72 POKE36877,160:POKEH,102:B=H:H=FNR(X):
   GOTO80
74 POKE36877,150:POKEI,102:B=I:I=FNR(X):
   GOTO80
76 POKE36877,180:POKEJ,102:B=J:J=FNR(X):
   GOTO80
78 POKE36877,190:POKEK,102:B=K:K=FNR(X)
80 SC=SC+10:POKEB,32:POKE36877,0
82 PRINT"{HOME}{BLU}{RVS}{22 SPACES}
   {OFF}":PRINT"{HOME}{WHT}SCORE =";SC:I
   FSC>500THEND=5
84 GOTO30
90 IFN<7724THENN=7724
92 IFN>8164THENN=8164
94 POKEN,90:GOTO30
100 POKE36877,220:FORC=38445TO38885STEP2
    2:POKEC,2:NEXTC:FORC=1TO100:NEXTC
110 FORC=38445TO38885STEP22:POKEC,1:NEXT
    C:POKE36877,0
120 PRINT"{WHT}GAME OVER"
130 FORC=1TO1000:NEXT:POKE36879,27
140 PRINT"{CLR}{BLU}{2 DOWN}YOUR FINAL S
    CORE WAS{3 SPACES}":PRINT"{RED}";SC:
    PRINT"{BLU}{2 DOWN}"
150 IF SC>TS THEN TS=SC
160 PRINT"HIGH SCORE = ";TS
170 PRINT"{GRN}{3 DOWN}TRY AGAIN? (Y/N)"
180 GETA$:IF A$="Y"THEN 10
185 IF A$<>"N" THEN 180
190 PRINT"{BLU}":END
200 POKE36879,186:PRINT"{CLR}{BLK}":PRIN
    TTAB(5);"** DEFEND **{2 DOWN}"
210 PRINTTAB(6);"BY REGENA"
220 PRINT"{2 DOWN}PRESS ↑ TO MOVE UP":PR
```

```
    INT"PRESS CRSR DOWN TO GO DOWN"
230 PRINT"{DOWN}PRESS F7 OR SPACE":PRINT
    "TO FIRE.{3 DOWN}"
240 PRINT"KEEP THE INVADERS FROMREACHING
     YOUR SIDE OF THE SCREEN."
250 PRINT"{2 DOWN}{RED}PRESS RETURN TO S
    TART";
260 GETA$:IFA$=""THEN 260
270 IF ASC(A$)=13 THEN 10
280 GOTO260
290 END
```

Program 4: Defend For The 64

```
1 TS=0:O=54272
2 DEF FNR(X)=1144+40*(INT(RND(0)*20)):GO
  TO 200
3 IFA$=CHR$(17)THENPOKEN,32:N=N+40
10 PRINT"{CLR}":POKE53281,12:N=1464:SC=0
   :D=5
15 PRINT"{HOME}{5}{RVS}{40 SPACES}
   {OFF}":PRINT"{HOME}{WHT}SCORE =";SC
20 POKEN,90
22 I=FNR(X):J=FNR(X):K=FNR(X):H=FNR(X)
24 IFH=IORH=JORH=KORI=JORI=KORJ=K THEN 2
   2
25 POKEH,42:POKEI,42:POKEJ,42:POKEK,42
30 GETA$:IFA$=CHR$(136)OR A$=CHR$(32)THE
   N 60
32 IFA$=CHR$(94)THENPOKEN,32:N=N-40:GOTO
   90
34 IFA$=CHR$(17)THENPOKEN,32:N=N+40:GOTO
   90
35 L=L+1:IFL<DTHEN30
36 H=H-1:I=I-1:J=J-1:K=K-1:L=0
37 IF(H-1024)/40=INT((H-1024)/40)THEN100
38 IF(I-1024)/40=INT((I-1024)/40)THEN100
40 IF(J-1024)/40=INT((J-1024)/40)THEN100
42 IF(K-1024)/40=INT((K-1024)/40)THEN100
44 POKEH+1,32:POKEI+1,32:POKEJ+1,32:POKE
   K+1,32:POKEH,42:POKEI,42:POKEJ,42
45 POKEK,42:POKEH+O,2:POKE I+O,2:POKEJ+O
   ,2:POKEK+O,2
50 GOTO30
60 FORM=200TO220:POKEN+O,1:POKEN+O,2:NEX
   T
62 IFH>NANDH<N+40THEN72
64 IFI>NANDI<N+40THEN74
66 IFJ>NANDJ<N+40THEN76
68 IFK>NANDK<N+40THEN78
70 SC=SC-5:GOTO82
72 POKEH,102:B=H:H=FNR(X):GOTO80
74 POKEI,102:B=I:I=FNR(X):GOTO80
76 POKEJ,102:B=J:J=FNR(X):GOTO80
78 POKEK,102:B=K:K=FNR(X)
80 SC=SC+10:POKEB,32
82 PRINT"{HOME}{5}{RVS}{40 SPACES}
   {OFF}":PRINT"{HOME}{WHT}SCORE =";SC
83 IFSC>500THEND=0
84 GOTO30
90 IFN<1104THENN=1104
92 IFN>1984THENN=1984
94 POKEN,90:POKEN+O,0:GOTO30
100 FORC=55377TO56257STEP40:POKEC,2:NEXT
    C:FORC=1TO100:NEXTC
110 FORC=55377TO55257STEP40:POKEC,1:NEXT
    C
120 PRINT"{WHT}GAME OVER"
130 FORC=1TO1000:NEXT:POKE53281,6:POKE53
    280,14
140 PRINT"{CLR}{BLU}{2 DOWN}YOUR FINAL S
    CORE WAS{3 SPACES}":PRINT"{RED}";SC:
    PRINT"{BLU}{2 DOWN}"
150 IF SC>TS THEN TS=SC
160 PRINT"HIGH SCORE = ";TS
170 PRINT"{GRN}{3 DOWN}TRY AGAIN? (Y/N)"
180 GETA$:IF A$="Y"THEN 10
185 IF A$<>"N" THEN 180
190 PRINT"{BLU}":END
200 POKE53281,12:PRINT"{CLR}{BLK}":PRINT
    TAB(5);"** DEFEND **{2 DOWN}"
210 PRINTTAB(6);"BY REGENA"
220 PRINT"{2 DOWN}PRESS ↑ TO MOVE UP":PR
    INT"PRESS CRSR DOWN TO GO DOWN"
230 PRINT"{DOWN}PRESS F7 OR SPACE":PRINT
    "TO FIRE.{3 DOWN}"
240 PRINT"KEEP THE INVADERS FROM"
245 PRINT"REACHING YOUR SIDE OF THE SCRE
    EN."
250 PRINT"{2 DOWN}{RED}PRESS RETURN TO S
    TART";
260 GETA$:IFA$=""THEN 260
270 IF ASC(A$)=13 THEN 10
280 GOTO260
290 END
```

Machine Language For Beginners

Program 1: VIC And 64 Disassembler

```
100 HE$="0123456789ABCDEF":PRINT"{CLR}"
110 L$="--------------------":J$="--->"
120 PRINT"{2 SPACES}DISASSEMBLER":PRINT:
    DIMM$(15,15)
130 FORI=0TO15:FORB=0TO14:READM$(I,B):NE
    XTB:NEXTI:PRINT"{CLR}";
140 REM START MAIN LOOP
150 PRINT"START ADDRESS(DECIMAL)":INPUTS
    A:TA=SA
160 PRINT"{UP}{8 RIGHT}(HEX=";:DE=SA:ZX=
    3:GOSUB970:PRINTH$")"
170 IFSA<0THENEND
180 I=SA
190 REM PRINT ADDRESS
200 PRINTI" ";
210 X=PEEK(I)
220 GOSUB1040
230 IFL%=15ORM$(H%,L%)="0"THENPRINT" ?
    {5 SPACES}"X:CK=0:LN=LN+1:GOTO260
240 PRINTM$(H%,L%);
250 GOSUB1070:IFEQTHENEQ=0
260 I=I+1
270 IFLN=18THENLN=0:GOTO1000
280 GOTO190
290 IFCK=12THEN320
300 B=PEEK(I+1):IFB>127THENB=((NOTB)AND2
    55)+1:B=-B
310 BAD=I+2+B:PRINT"{3 SPACES}"BAD:I=I+1
    :RETURN
320 IFH%>8THEN730
330 IFH%=2THENJ=1:GOTO750
340 IFH%=6THENPRINT:PRINTL$:EQ=1:RETURN
350 IFH%=6THENRETURN
360 PRINT
370 RETURN
380 IFCK=12THEN410
```

```
390 PRINT" ("PEEK(I+1)"),Y"
400 I=I+1:RETURN
410 PRINT" ("PEEK(I+1)",X)"
420 I=I+1:RETURN
430 IFCK=12THEN460
440 PRINT" "PEEK(I+1)",X"
450 I=I+1:RETURN
460 PRINT"{2 SPACES}"PEEK(I+1)
470 I=I+1:RETURN
480 IFCK=12THEN510
490 PRINT" "PEEK(I+1)",X"
500 I=I+1:RETURN
510 PRINT"{2 SPACES}"PEEK(I+1)
520 I=I+1:RETURN
530 IFCK=12THEN510
540 IFH%=9ORH%=11THENPRINT" "PEEK(I+1)",
    Y"
550 IFH%=7ORH%=15ORH%=5ORH%=3THEN480
560 IFH%=13THEN440
570 PRINT:GOTO500
580 PRINT: RETURN
590 IFCK=12THEN730
600 I$="Y":GOTO750
610 IFCK=12THEN630
620 I$="X":GOTO750
630 IFH%=6THENPRINT" (IND.{2 SPACES}";:I
    =I+1
640 IFH%=2THEN750
650 IFH%=4THENPRINTJ$;:GOTO750
660 IFH%=8ORH%=10ORH%=12ORH%=14THEN750
670 GOTO380
680 IFCK=12THEN750
690 I$="X":GOTO750
700 IFCK=12THEN750
710 IFH%=11THENI$="Y":GOTO750
720 I$="X":GOTO750
730 PRINT"{3 SPACES}#"PEEK(I+1)
740 I=I+1:RETURN
750 N=PEEK(I+1)+PEEK(I+2)*256
760 IFI$=""THEN800
770 IFI$="X"THENPRINT"{2 SPACES}"N",X"
780 IFI$="Y"THENPRINT"{2 SPACES}"N",Y"
790 I$="":I=I+2:RETURN
800 PRINTN:I=I+2
810 RETURN
820 DATABRK,ORA,0,0,0,ORA,ASL,0,PHP,ORA,
    ASL,0,0,ORA,ASL,BPL,ORA,0,0,0,ORA,AS
    L
830 DATA0,CLC,ORA,0,0,0,ORA,ASL,JSR,AND,
    0,0,BIT,AND,ROL,0,PLP,AND,ROL,0,BIT
840 DATAAND,ROL,BMI,AND,0,0,0,AND,ROL,0,
    SEC,AND,0,0,0,AND,ROL,RTI,EOR,0,0,0
850 DATAEOR,LSR,0,PHA,EOR,LSR,0,JMP,EOR,
    LSR,BVC,EOR,0,0,0,EOR,LSR,0,CLI,EOR,
    0
860 DATA0,0,EOR,LSR,RTS,ADC,0,0,0,ADC,RO
    R,0,PLA,ADC
870 DATAROR,0,JMP,ADC,ROR,BVS,ADC,0,0,0
880 DATAADC,ROR,0,SEI,ADC,0,0,0,ADC,ROR,
    0,STA
890 DATA0,0,STY,STA,STX,0,DEY,0,TXA,0,ST
    Y,STA
900 DATASTX,BCC,STA,0,0,STY,STA,STX,0,TY
    A,STA,TXS,0,0,STA,0,LDY,LDA,LDX,0
910 DATALDY,LDA,LDX,0,TAY,LDA,TAX,0,LDY,
    LDA,LDX,BCS,LDA,0,0,LDY,LDA,LDX,0
920 DATACLV,LDA,TSX,0
930 DATALDY,LDA,LDX,CPY,CMP,0,0,CPY,CMP,
    DEC,0,INY,CMP,DEX,0,CPY,CMP,DEC
940 DATABNE,CMP,0,0,0,CMP,DEC,0,CLD,CMP,
    0,0,0,CMP,DEC,CPX,SBC,0,0,CPX,SBC,IN
    C
950 DATA0,INX,SBC,NOP,0,CPX,SBC,INC,BEQ,
    SBC,0,0,0,SBC,INC,0,SED,SBC,0,0,0,SB
    C
960 DATAINC
970 REM MAKE DECIMAL INTO HEX
980 H$="":FORM=ZXTO0STEP-1:N%=DE/(16↑M):
    DE=DE-N%*16↑M:H$=H$+MID$(HE$,N%+1,1)
990 NEXT:RETURN
1000 PRINT"TYPE C FOR" I
1010 GETK$:IFK$=""THEN1010
1020 IFK$="C"THENSA=I:TA=SA:GOTO170
1030 INPUTSA:TA=SA:GOTO170
1040 REM ANALYZE H & L OF OPCODE
1050 H%=X/16:L%=X-H%*16
1060 :RETURN
1070 REM FIND ADDRESS TYPE & GOSUB
1080 CK=H%/2:IFCK=INT(CK)THENCK=12
1090 L%=L%+1
1100 ONL%GOSUB290,380,730,1130,480,480,5
     30,1130,580,590,580,1130,610,680,70
     0
1110 CK=0
1120 LN=LN+1
1130 RETURN
```

Program 2: RAMtest Fragment

```
800 FORADRES=884TO930:READ DATTA:POKEADR
    ES,DATTA:NEXTADRES
882 DATA169,8,133,58
888 DATA169,0,133,57,160,0
894 DATA24,141,0,4,145,57
900 DATA209,57,240,21,152,72
906 DATA165,58,72,32,179,3
912 DATA104,133,58,104,168,169
918 DATA0,230,57,208,7,230
924 DATA58,24,105,1,208,221,200
```

Program 3: Disassembly Of Fragment

```
884  LDA   # 8
886  STA   58
888  LDA   # 0
890  STA   57
892  LDY   # 0
894  CLC
895  STA 1024
898  STA ( 57 ),Y
900  CMP ( 57 ),Y
902  BEQ    925
904  TYA
905  PHA
906  LDA   58
908  PHA
909  JSR 947
912  PLA
913  STA   58
915  PLA
916  TAY
917  LDA   # 0
919  INC   57
921  BNE    930
923  INC   58
925  CLC
926  ADC   # 1
928  BNE    895
930  INY
```

Power BASIC

64 Searcher

```
40 T=49152:FORI=TTOT+150:READA:POKEI,A:C
   S=CS+A:NEXTI
50 IFCS<>20528THENPRINT"ERROR IN DATA ST
   ATEMENTS":STOP
60 PRINT"{CLR}SYS";T;"TO START":END
100 DATA160,0,177,43,133,251,200,177,43,
    133,252,160,0,177,251,208
110 DATA1,200,177,251,208,1,96,160,0,177
    ,251,141,52,3,200,177
120 DATA251,141,53,3,200,177,251,133,99,
    200,177,251,133,98,200,24
130 DATA165,43,105,5,133,67,166,44,144,1
    ,232,134,68,177,251,240
140 DATA55,162,0,193,67,240,4,200,24,144
    ,242,192,0,240,10,136
150 DATA230,251,208,2,230,252,24,144,242
    ,160,0,177,67,240,8,209
160 DATA251,208,218,200,24,144,244,169,3
    5,32,210,255,166,99,165,98
170 DATA32,205,189,169,32,32,210,255,173
    ,52,3,133,251,173,53,3
180 DATA133,252,24,144,134
190 DATA173,230,159,141,19,3,173,231,159
    ,141,19,3,169,128,32,144,255,0
```

64 Explorer

BEFORE TYPING...

Before typing in programs, please refer to "How To Type COMPUTE!'s Gazette Programs" and "A Beginner's Guide To Typing In Programs" that appear before the Program Listings.

Single Drive File Copy

```
20 REM SINGLE DRIVE FILE COPY
40 POKE 52,31:POKE 56,31:CLR
45 FOR I=0 TO 173
50 READ D:POKE 7936+I,D:NEXT
55 POKE 785,0:POKE 786,31
60 PL$=CHR$(19)
65 FOR I=1 TO 24:PL$=PL$+CHR$(17):NEXT
70 FOR I=1 TO 39:CL$=CL$+" ":NEXT
75 CL$=CL$+CHR$(13)+CL$+CHR$(13)
80 CL$=LEFT$(PL$,21)+CL$+CHR$(145)+CHR$(
   145)
85 OPEN 15,8,15:REM OPEN ERROR CHAN
90 GOTO 1000
110 REM READ THE DIRECTORY
130 POKE 785,0:REM SELECT READ FUNCTION
140 PRINT#15,"I":OPEN 2,8,2,"$"
150 NB=USR(2):REM LOAD DIR INTO MEM
160 CLOSE 2:GOSUB 800:REM CHECK ERROR
170 RETURN
210 REM DISPLAY DISK NAME
230 POKE 785,6:REM SELECT FETCH CHAR
240 PRINT LEFT$(PL$,3);CHR$(18);
250 FOR K=142 TO 169
260 PRINT CHR$(USR(K));:NEXT
270 PRINT CHR$(146)
280 RETURN
310 REM PRINT DIRECTORY ENTRY DE
330 POKE 785,6:REM SELECT FETCH CHAR
340 IX=(DE-1)*32+254-INT((DE-1)/8)*2
345 IF USR(IX)<128 THEN RETURN
350 TY=USR(IX)-128:IF TY=0 OR TY>3 THEN
    RETURN
360 FOR K=IX+3 TO IX+18
370 PRINT CHR$(USR(K));
380 NEXT:PRINT TAB(16);",";
390 PRINT MID$("SPU",TY,1):RETURN
410 REM GET DESTINATION DISK
430 PRINT CL$;
440 PRINT "INSERT DESTINATION DISK."
450 PRINT "PRESS ";CHR$(18);"RETURN";
460 PRINT CHR$(146);" WHEN READY."
470 GET DM$:IF DM$="" GOTO 470
480 IF DM$<>CHR$(13) GOTO 470
490 PRINT#15,"I":RETURN
510 REM GET A FILE TO COPY
530 PRINT CL$;:IF EN=63 GOTO 580
540 IF UE=128 THEN PRINT NM$;" TOO LARGE
    .";
550 IF EN=62 THEN PRINT NM$;" NOT FOUND.
     ";
560 PRINT "ENTER FILE,TYPE":NM$="":EN=0:
    UE=0
570 INPUT NM$,TY$:RETURN
580 PRINT NM$;" EXISTS. ENTER NEW NAME"
590 EN=0:NM$="":INPUT NM$:RETURN
610 REM READ THE FILE
630 POKE 785,0:REM SELECT READ FUNCTION
640 OPEN 2,8,2,NM$+","+TY$+",R"
650 GOSUB 900:IF EN<>0 THEN CLOSE 2:RETU
    RN
660 NB=USR(2):REM READ THE FILE
670 CLOSE 2:GOSUB 800:REM CHECK RESULTS
680 RETURN
710 REM WRITE THE FILE
730 POKE 785,3:REM SELECT WRITE FUNCTION
740 OPEN 2,8,2,NM$+","+TY$+",W"
750 GOSUB 900:IF EN<>0 THEN CLOSE 2:RETU
    RN
760 NB=USR(2):REM WRITE THE BYTES
770 CLOSE 2:GOSUB 800:REM CHECK RESULTS
780 RETURN
810 REM CHECK USR() RETURN VALUE
830 NB=NB-(NB<0)*65536
840 IF NB<61440 THEN UE=0:RETURN
850 IF NB=61440 THEN UE=128:RETURN
860 PRINT CL$;
870 IF PEEK(785)=0 THEN PRINT "READ";
880 IF PEEK(785)=3 THEN PRINT "WRITE";
890 PRINT " ERROR #";NB-61440:END
910 REM READ ERROR CHANNEL
940 INPUT#15,EN,EM$,ET,ES
950 IF EN=0 OR EN=62 OR EN=63 THEN RETUR
    N
960 CLOSE 15:PRINT CL$;
970 PRINT "DISK ERROR #";EN
980 PRINT LEFT$(PL$,22);EM$:END
1010 REM MAIN ROUTINE
1030 PRINT CHR$(147);:REM CLEAR SCREEN
1040 PRINT "{7 SPACES}SINGLE DRIVE FILE
     COPY"
1050 PRINT:PRINT "READING DIRECTORY"
1060 GOSUB 100:REM READ THE DIRECTORY
1070 GOSUB 200:REM DISPLAY TITLE
1080 NS=INT((NB+1)/254)
1090 IF NS=1 GOTO 5000:REM NO FILES
1100 DS=1
1110 IF NS<=DS THEN DS=1:REM START OVER
```

```
1120 PRINT LEFT$(PL$,4);
1130 BE=(DS-1)*8+1:LE=BE+15
1140 IF DS+1=NS THEN LE=BE+8
1150 FOR DE=BE TO LE
1160 GOSUB 300:NEXT:REM DISPLAY FILES
1170 FOR I=PEEK(214) TO 20:REM CLEAR
1180 PRINT "{20 SPACES}"
1190 NEXT
1200 GOSUB 500:REM GET FILE NAME
1210 IF NM$="" THEN DS=DS+2:GOTO 1110
2010 REM COPY THE FILE
2030 PRINT CL$;
2040 PRINT "READING ";NM$
2050 GOSUB 600:REM READ THE FILE
2060 IF EN=62 OR UE=128 GOTO 1200
2070 BC=NB:REM SAVE COUNT
2080 GOSUB 400:REM GET DEST. DISK
2090 PRINT CL$;"WRITING ";NM$
2100 GOSUB 700:REM WRITE THE FILE
2110 IF EN=0 GOTO 3000
2120 GOSUB 500:REM GET NEW FILE
2130 IF NM$<>"" GOTO 2090
2140 PRINT CL$;"FILE NOT COPIED"
2150 GOTO 3100
3010 REM DISPLAY COMPLETION STATUS
3030 PRINT CL$;
3040 IF NB<>BC GOTO 3060
3050 PRINT "COPY SUCCESSFUL.{2 SPACES}";
     :GOTO 3070
3060 PRINT "ERROR. ONLY ";NB;" OUT ";
3070 PRINT BC;"BYTES COPIED."
3100 PRINT "PRESS ";CHR$(18);
3110 PRINT "RETURN";CHR$(146);
3120 PRINT " TO COPY ANOTHER FILE"
3130 GET DM$:IF DM$="" GOTO 3130
3140 IF DM$=CHR$(13) GOTO 1000
3150 END
4010 REM NO FILES ERROR HANDLING
4030 PRINT LEFT$(PL$,21);
4040 PRINT "NO FILES ON THIS DISK."
4050 PRINT "PRESS RETURN TO TRY ";
4060 PRINT "ANOTHER DISK.";
4070 GET DM$:IF DM$="" GOTO 4070
4080 IF DM$=CHR$(13) GOTO 1000
4090 END
10000 DATA 76,15,31,76,88,31,76,154
10010 DATA 31,108,3,0,108,5,0,32
10020 DATA 9,31,152,170,32,198,255,168
10030 DATA 176,57,169,0,133,251,169,32
10040 DATA 133,252,160,0,32,207,255,145
10050 DATA 251,230,251,208,2,230,252,165
10060 DATA 144,208,13,165,252,201,160,14
      4
10070 DATA 235,32,204,255,160,0,240,19
10080 DATA 164,144,32,204,255,192,64,208
10090 DATA 10,164,251,165,252,56,233,32
10100 DATA 76,12,31,169,240,76,12,31
10110 DATA 32,9,31,152,170,32,201,255
10120 DATA 168,176,240,165,251,141,174,3
      1
10130 DATA 165,252,141,175,31,169,0,133
10140 DATA 251,169,32,133,252,160,0,177
10150 DATA 251,32,210,255,164,144,208,20
10160 DATA 230,251,208,2,230,252,165,252
10170 DATA 205,175,31,144,234,165,251,20
      5
10180 DATA 174,31,144,227,32,204,255,76
10190 DATA 73,31,32,9,31,132,251,24
10200 DATA 105,32,133,252,160,0,177,251
10210 DATA 168,169,0,76,12,31
```

VICreations

BEFORE TYPING...

Before typing in programs, please refer to "How To Type COMPUTE!'s Gazette Programs" and "A Beginner's Guide To Typing In Programs" that appear before the Program Listings.

Rolling Dice

```
1 POKE36879,27:SC=7771:CO=38491:X=RND(-TI
  ):GOTO10
2 A=A+4:RETURN
3 A=A+7:RETURN
10 PRINT"{CLR}{DOWN}{BLK}YOU THREW A:
   {DOWN}"
20 PRINT"{2 SPACES}O{5 T}P"TAB(13)"O
   {5 T}P"
30 PRINT"{2 SPACES}{G}"TAB(8)"{M}"TAB
   (13)"{G}"TAB(19)"{M}"
40 PRINT"{2 SPACES}{G}"TAB(8)"{M}"TAB
   (13)"{G}"TAB(19)"{M}"
50 PRINT"{2 SPACES}{G}"TAB(8)"{M}"TAB
   (13)"{G}"TAB(19)"{M}"
60 PRINT"{2 SPACES}{G}"TAB(8)"{M}"TAB
   (13)"{G}"TAB(19)"{M}"
70 PRINT"{2 SPACES}{G}"TAB(8)"{M}"TAB
   (13)"{G}"TAB(19)"{M}"
80 PRINT"{2 SPACES}L{5 @}@"TAB(13)"L
   {5 @}@{BLU}"
90 A=SC:B=81:FORC=1TO3:POKEA,B:GOSUB2:POK
   EA,B:GOSUB3:POKEA,B:GOSUB2
100 POKEA,B:A=A+29:NEXT
110 FORD=1TO25:A=CO:FORC=1TO3
112 C1=INT(RND(1)*8)+0
114 C2=INT(RND(1)*8)+0
116 C3=INT(RND(1)*8)+0
118 POKEA,C1:GOSUB2:POKEA,C2
120 GOSUB3:POKEA,C3:GOSUB2:POKEA,C1:A=A+2
    9
150 NEXTC:NEXTD
160 D1=INT(RND(1)*6)+1
170 D2=INT(RND(1)*6)+1
180 A=SC:B=32:FORC=1TO3:POKEA,B:GOSUB2:PO
    KEA,B:GOSUB3:POKEA,B:GOSUB2
185 POKEA,B:A=A+29:NEXT
190 A=CO:B=0:FORC=1TO3:POKEA,B:GOSUB2:POK
    EA,B:GOSUB3:POKEA,B:GOSUB2
195 POKEA,B:A=A+29:NEXT:POKECO+46,0:POKEC
    O+57,0
200 A=0:OND1GOSUB210,215,220,225,230,235
205 A=11:OND2GOSUB210,215,220,225,230,235
    :GOTO300
210 POKESC+46+A,81:RETURN
215 POKESC+A,81:POKESC+92+A,81:RETURN
220 POKESC+A,81:POKESC+46+A,81:POKESC+92+
    A,81:RETURN
225 POKESC+A,81:POKESC+4+A,81:POKESC+88+A
    ,81:POKESC+92+A,81:RETURN
230 POKESC+A,81:POKESC+4+A,81:POKESC+46+A
    ,81:POKESC+88+A,81:POKESC+92+A,81
232 RETURN
235 POKESC+A,81:POKESC+4+A,81:POKESC+44+A
    ,81:POKESC+48+A,81:POKESC+88+A,81
237 POKESC+92+A,81:RETURN
300 PRINTTAB(4)"{DOWN}"D1;TAB(15)D2
310 FORT=1TO1500:NEXTT:GOTO10
```

TeleTerm 64

```
1 CLOSE2:RESTORE:CLR
2 OPEN2,2,3,CHR$(6+32)+CHR$(32+64)
5 PRINT"{CLR}"
6 POKE53280,0:POKE53281,0
10 REM 64 TO ASCII
20 DIMO%(256)
30 FORX=0TO255
35 O%(X)=X
40 IFO%(X)>64ANDO%(X)<99THENO%(X)=O%(X)+
   32
50 IFO%(X)>192ANDO%(X)<219THENO%(X)=O%(X
   )-128
51 O%(20)=127
52 O%(133)=8
53 REM SPECIAL FUNCTIONS (OUT) CAN GO HE
   RE
60 NEXTX
70 REM ASCII TO 64
80 DIMI%(256)
90 FORY=0TO256
100 IFI%(Y)>64ANDI%(Y)<91THENI%(Y)=I%(Y)
    +128
110 IFI%(Y)>96ANDI%(Y)<123THENI%(Y)=I%(Y
    )-32
123 I%(8)=157
124 I%(Y)=Y
125 REM SPECIAL FUNCTIONS (IN) CAN GO HE
    RE)
130 NEXTY
140 PRINT"READY"
145 FORT=1TO100:NEXT
210 PRINTCHR$(14);"{CLR}";
300 GETO$:IFO$=""THEN400
320 B%=ASC(O$):O%=O%(B%):O$=CHR$(O%):PRI
    NT#2,O$;:POKE646,1
400 GET#2,I$:IFI$=""THEN300
420 A%=ASC(I$):I%=I%(A%):I$=CHR$(I%):PRI
    NTI$;:GOTO300
450 END
```

Bug-Swatter:
Modifications And Corrections

A few errors in our Premier Issue of COMPUTE!'s Gazette have been brought to our attention by readers:

• In "Skydiver" for both the VIC and 64, a quirk in the way the printer listed the program makes it unclear that two spaces should be typed in line 100. The absence of these spaces causes the plane to appear as a continuous streak. A space should be typed before pressing the RVS key each time in line 100. Here is a proper listing:

```
100 PRINT"{HOME}{DOWN}";TAB(A);"{OFF} {RV
    S}[*][2 LEFT]{DOWN}{OFF} {RVS}[2 I]":
    A=A+1
```

• In the column "Machine Language For Beginners," the sample program fell victim to the compatibility problem we explained in "Commodore 64 Video Update" in the same issue. In that article we described how a change to the Commodore 64's video chip has altered the clear-screen routine in newer-model 64s. This means that some of you with computers affected by the change saw nothing but a blank screen when you tried the sample program accompanying "Machine Language For Beginners."

For a fix, try typing this small routine before running the sample program:

```
FOR X=1 TO 1000:POKE 55295+X,1:NEXT
```

[Press RETURN]

As explained on page 44 of the Premier Issue, this fills color memory with the code for white so that characters POKEd directly into screen memory will actually appear. It takes several seconds to execute. There are several other, faster ways of accomplishing the same thing; watch future issues.

• In the "VICreations" column, an equals sign was inadvertently omitted from Program 5 on page 77. Line 40 should read:

```
40 TI$="000000":SYS7168:PRINT TI/60:END
```

This statement resets the VIC-20's built-in realtime clock to zero, jumps to the machine language routine, and then prints the elapsed time in seconds before ending the program. Without the equals sign, line 40 would result in an error message.

****

We also received a modification for a program in the Premier Issue:

• "Alfabug" can be changed so that the child must press a key to move the bugs just one step instead of the whole length of the race course. Helen J. Festa suggests altering line 115 in either the VIC or 64 version so that "THEN81" reads "THEN76". The complete line should look like this:

```
115 CR=CR+IN:IN=IN*-1:IFF<53THEN76
```

We appreciate receiving both corrections and suggested modifications from readers. Please address them to:

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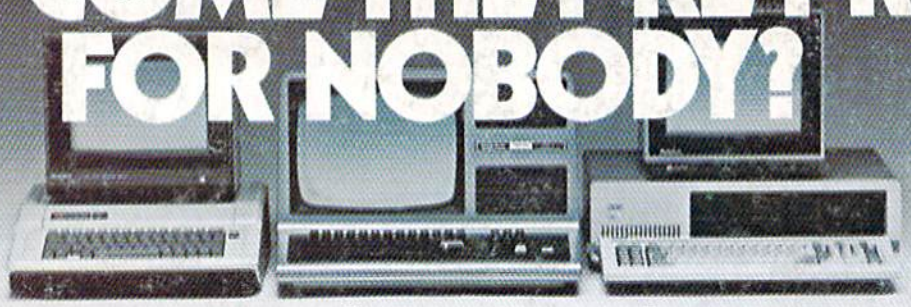

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